

AD-A156 443 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS 1/1
PISGAH RESERVOIR DAM (.) (U) CORPS OF ENGINEERS WALTHAM
MA NEW ENGLAND DIV JUL 79

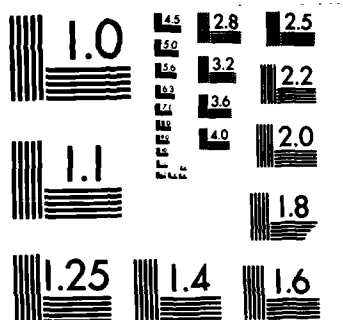
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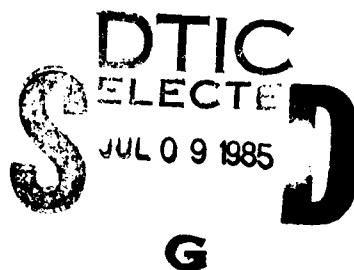
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CONNECTICUT RIVER BASIN
WINCHESTER, NEW HAMPSHIRE

PISGAH RESERVOIR DAM
NH 00301

STATE NO 255.11

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

JULY 1979

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| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam has a hydraulic height of 30 ft. and is 90 ft. long, The dam is in poor condition. There are some major concerns which should be implemented. The dam is small in size with a significant hazard potential. The test flood is $\frac{1}{2}$ the PMF. A major breach at top of dam probably would not result in the loss of lives, but could cause appreciable property damage. s | | |



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED

DEC 06 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

Inclosed is a copy of the Pisgah Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, the New Hampshire Division of Parks and Recreation.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely,


MAX B. SCHEIDER

Colonel, Corps of Engineers
Division Engineer

Incl
As stated

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.: NH00301
Name of Dam: Pisgah Reservoir Dam
Town: Winchester
County and State: Cheshire County, New Hampshire
Stream: Pisgah Brook
Date of Inspection: May 2, 1979

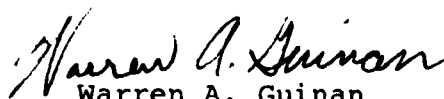
BRIEF ASSESSMENT

Pisgah Reservoir Dam has a hydraulic height of 30 feet, is of varied topwidth and is 90 feet long. It is a vertical stone masonry dam with earthfill on the upstream side which is used as a service road. There is a 60-foot long overflow spillway dike approximately 100 feet east of the dam. The dam has a drain gate located near the base of the structure which is inoperable. The dam spans a reach of Pisgah Brook, and is located in southwest New Hampshire. The pond is 1½ miles long and has a surface area of about 110 acres. The dam contains runoff from a 2.4 square mile drainage area and has a maximum storage of 950 acre-feet. Pisgah Reservoir Dam is now used for recreational purposes.

The dam is in poor condition. Major concerns are: a substantial leak or seep near the downstream toe and bulging of the dam face, irregular crest alignment of both the spillway and the dam, fallout of a large boulder from the downstream face of the dam, and debris clogged channels downstream of both the spillway and the dam.

Based on small size and significant hazard classification in accordance with Corps guidelines, the test flood is ½ the Probable Maximum Flood (PMF). The routed test flood outflow of 2100 cfs (875 csm) would overtop the dam by 1.8 feet (4.3 feet over spillway crest). The spillway capacity at the top of dam is 438 cfs, which is 21 percent of the test flood discharge. A major breach at top of dam probably would not result in the loss of lives, but could cause appreciable property damage.

The owner, New Hampshire Division of Parks and Recreation, should implement the results of the recommendations and remedial measures given in Sections 7.2 and 7.3 within one year after receipt of this Phase I Report.


Warren A. Guinan
Project Manager
N.H. P.E. No. 2339

This Phase I Inspection Report on Pisgah Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Joseph A. McElroy

JOSEPH A. MCELROY, MEMBER
Foundation & Materials Branch
Engineering Division

Carney M. Terzian

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

Joseph W. Finegan, Jr.

JOSEPH W. FINEGAN, JR., CHAIRMAN
Chief, Reservoir Control Center
Water Control Branch
Engineering Division

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APPROVAL RECOMMENDED:

Joe B. Fryar
JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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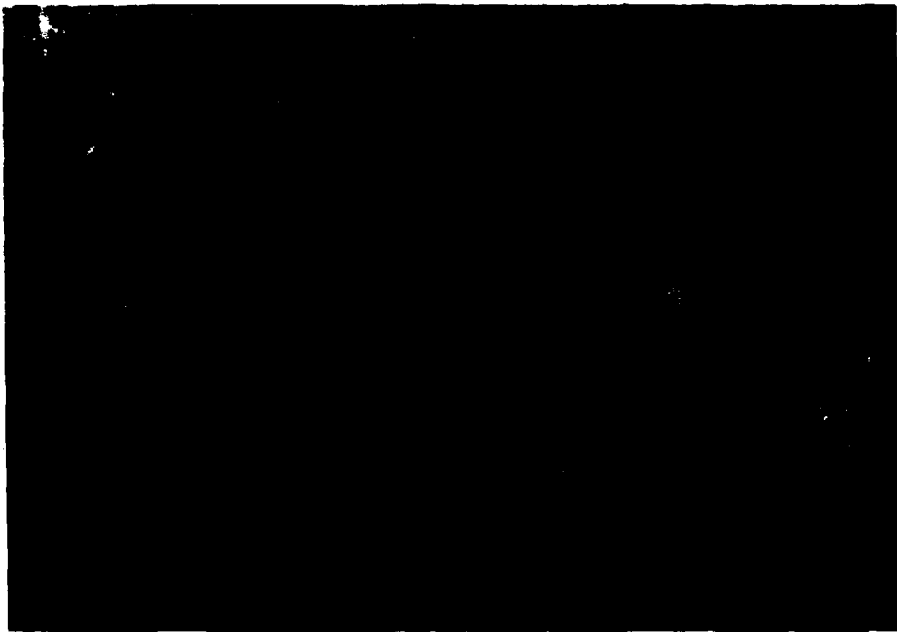
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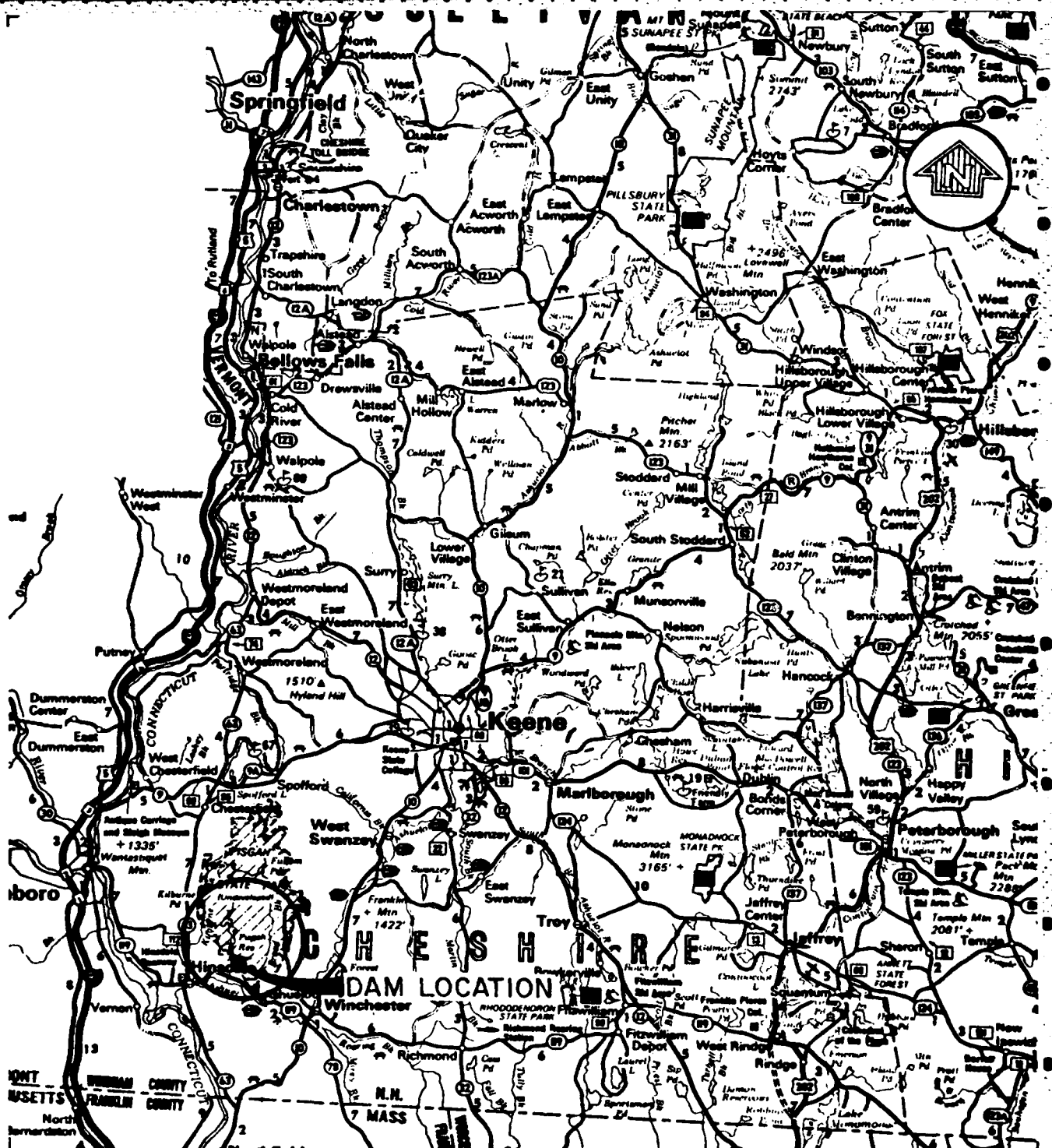
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May 1979

Figure 1 - Overview of Pisgah Reservoir Dam.



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SCALE IN MILES



MAP BASED ON STATE OF NEW HAMPSHIRE
OFFICIAL HIGHWAY MAP.

| | | | |
|---|--|-------------------------------------|--|
| Anderson-Nichols & Co., Inc. | | U.S. ARMY ENGINEER DIV. NEW ENGLAND | |
| CONCORD | | CORPS OF ENGINEERS | |
| NEW HAMPSHIRE | | WALTHAM, MASS. | |
| NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS | | | |
| PISGAH RESERVOIR DAM | | | |
| LOCATION MAP | | | |
| PISGAH BROOK | | NEW HAMPSHIRE | |
| | | SCALE: SEE BAR SCALE | |
| | | DATE: JULY, 1979 | |

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT
PISGAH RESERVOIR DAM

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972 authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Anderson-Nichols & Company, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of New Hampshire. Authorization and notice to proceed were issued to Anderson-Nichols under a letter of November 20, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-79-C0009 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) To perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) To encourage and prepare the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Pisgah Reservoir Dam is located in Winchester, New Hampshire and spans Pisgah Brook. After discharging over the dam, Pisgah Brook flows south to Tufts Pond $\frac{1}{4}$ mile downstream. The stream discharging from Tufts Pond is Tufts Brook, which flows southerly approximately 1.2 miles before becoming confluent with the Ashuelot River at a point approximately 3.5 miles upstream of the Ashuelot River's confluence with the Connecticut River. Pisgah Reservoir Dam is shown on U.S.G.S. Quadrangle, Keene, N.H. - Vt., with coordinates approximately at N 42° 48' 36", W 72° 26' 54", Cheshire County, New Hampshire. (See Location Map page vii.)

b. Description of Dam and Appurtenances. Pisgah Reservoir Dam is a gravity stone-masonry dam with earth (and probably some rock) fill behind it that carries a service road. The dam has a hydraulic height of 30 feet, is 90 feet long with about a 20-foot topwidth. A 60-foot side-channel overflow spillway dike is located

approximately 100 feet east of the dam. A dike, 130 feet long, blocks a saddle just west of the dam about 100 feet. The faces are masonry block; the dike is perpendicular to the dam. The low-level drain gate is reported to be blocked with earthfill.

c. Size Classification. Small (hydraulic height - 30 feet; storage - 950 acre-feet) based on height and storage (≥ 25 feet to < 40 feet and ≥ 50 to < 1000 acre-feet as given in Recommended Guidelines for Safety Inspection of Dams.

d. Hazard Classification. Significant Hazard. A major breach probably would not result in the loss of lives but could cause appreciable property damage. (See Section 5.1 f.)

e. Ownership. Pisgah Reservoir Dam was constructed at some unknown date around 1870. The earliest recorded ownership found was the Dickinson Real Estate and Lumber Company prior to 1923. Ownership was passed to the New Hampshire Division of Parks and Recreation in 1969.

f. Operator. The current owner and operator of Pisgah Reservoir Dam is the New Hampshire Division of Parks and Recreation, Bos 856, Concord, New Hampshire, 03301; (603) 271-3556.

g. Purpose of Dam. The original purpose for the construction of the dam was not revealed. Under ownership by the Dickinson Real Estate and Lumber Company, the dam was utilized to provide upstream water storage for their saw mill operations. Presently, the reservoir is used for recreational purposes.

h. Design and Construction History. Little information was obtained regarding the original design and construction of the stone masonry dam. Two design plans were obtained, drawn by I.W. Jones & Co., Engineers, Milton, New Hampshire and dated September 18, 1923. One plan is entitled "Plan, Elevation & Section of Storage Dam at Pisgah Reservoir"; the other is entitled "Details of Gate and Gate Frame and Rack and Rack Frame at Pisgah Reservoir". These plans were for repairs to the dam. No construction records were found regarding these repairs.

i. Normal Operating Procedures. No written operational procedures were revealed for Pisgah Reservoir Dam. The drain gate is inoperable because of backfilling on the upstream side of the dam.

1.3 Pertinent Data

a. Drainage Area. The drainage area consists of 2.4 square miles (1536 acres) of mountainous terrain. The normal surface area of Pisgah Reservoir is 110 acres, which constitutes 7 percent of the watershed.

b. Discharge at Dam Site

(1) Outlet Works (conduit) - Drain gate 2.5'H x 4'W at

invert elevation 860.4' MSL is inoperable because of fill on upstream side of the dam.

- (2) The maximum discharge at the damsite is unknown.
- (3) Ungated spillway capacity at top of dam elevation - 438 cfs @ 880.5' MSL
- (4) Ungated spillway capacity at test flood elevation - 1120 cfs @ 882.3' MSL
- (5) Gated spillway capacity at top of dam elevation - not applicable
- (6) Gated spillway capacity at test flood elevation - not applicable
- (7) Total spillway capacity at test flood elevation - 1120 cfs @ 882.3' MSL
- (8) Total project discharge at test flood elevation - 2100 cfs @ 882.3' MSL

c. Elevation (feet above MSL; see (6) below)

- (1) Streambed at centerline of dam - 850.3 (at downstream toe)
- (2) Maximum tailwater - unknown
- (3) Upstream invert drain gate - 360.4
- (4) Recreational pool - 878
- (5) Full flood control pool - not applicable
- (6) Spillway crest - 878 (shown on U.S.G.S. Quadrangle Sheet and assumed to be spillway crest)
- (7) Design Surcharge (Original Design) - unknown
- (8) Top of dam - 880.5
- (9) Test flood - 882.3

d. Reservoir (miles)

- (1) Length of maximum pool - 1.7
- (2) Length of recreational pool - 1.5
- (3) Length of flood control pool - not applicable

e. Storage (acre-feet)

- (1) Recreation pool - 660
- (2) Flood control pool - not applicable
- (3) Spillway crest pool - 660
- (4) Top of dam - 950
- (5) Test flood pool - 1220

f. Reservoir Surface (acres)

- (1) Recreation pool - 110
- (2) Flood control pool - not applicable
- (3) Spillway crest - 110
- (4) Test flood pool - 210
- (5) Top of dam - 190

g. Dam

(1) Type - stone masonry gravity dam on ledge with earth fill at upstream side of dam which carries a service road.

- (2) Length - 90'
- (3) Height - 33' (structural height)
- (4) Topwidth - about 20'

(5) Side slopes - Upstream face is vertical and downstream face slope is 2.5H:8V for the dam. The spillway downstream face is vertical and the upstream face slope is 2H:1V.

- (6) Zoning - not applicable
- (7) Impervious core - not applicable
- (8) Cutoff - unknown
- (9) Grout curtain - unknown

h. Diversion and Regulating Tunnel - not applicable
(See j. below.)

i. Spillway

- (1) Type - stone masonry downstream and earth fill upstream
- (2) Length of weir - 60'
- (3) Crest elevation - 878' MSL

(4) Gates - none

(5) U/S Channel - Pisgah Brook flows downstream from the mountains into Pisgah Reservoir. No structures are upstream of the reservoir. The reservoir is of varying width.

(6) D/S Channel - Discharge over the spillway flows in a 20-foot wide steep channel with heavily wooded banks. The top of banks are approximately 75' wide. Pisgah Brook flows downstream $\frac{1}{4}$ mile to Tufts Pond. Downstream of Tufts Pond the brook is called Tufts Brook and flows south approximately 1 mile where it passes through a culvert under Rte. 119. It then flows approximately 0.2 mile to its confluence with the Ashuelot River. Two houses are located, one on either bank upstream of the Route 119 culvert. Each house has its lowest floor about 12 feet above the road at the center of the culvert. These houses are about 130 to 150 feet from the center line of the stream. The banks of Tufts Brook are quite steep and the banks supporting these houses could be undercut by a major flood in the brook.

j. Regulating Outlets. A 2.5'H x 4'W drain gate is located near the center of the dam at invert elevation 860.4' MSL. This gate is inoperable which is due to earth fill placed on the upstream side of the dam.

SECTION 2 ENGINEERING DATA

2.1 Design

No original design data were disclosed for Pisgah Reservoir Dam. Two plans, dated September 18, 1923, were disclosed for repairs. These plans were designed by I.W. Jones & Co., Engineers, Milton, New Hampshire. One plan was entitled "Plan, Elevation & Section of Storage Dam at Pisgah Reservoir"; the other was entitled "Details of Gate and Gate Frame and Rack and Rack Frame at Pisgah Reservoir".

2.2 Construction Records

No written construction records were disclosed for either the original dam or for the repairs designed in 1923.

2.3 Operation

No engineering operational data were disclosed.

2.4 Evaluation

a. Availability. Limited engineering data were available for Pisgah Reservoir Dam. A search of the files of the NHWRB and direct contact with the owner revealed only a limited amount of recorded information.

b. Adequacy. Because of the limited amount of detailed data available, the final assessments and recommendations of this investigation are based on the hydrologic and hydraulic calculations and the visual inspection.

c. Validity. No engineering data were disclosed to validate. A few elements of the two plans disclosed are in general conformity with the dam as noted in the visual inspection. The addition of upstream fill behind the stone masonry obscures many of the details.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. General. Pisgah Dam is a low dam which impounds a reservoir of small size. The watershed above the reservoir is rolling and heavily wooded. The outflow from the reservoir flows about one-quarter mile downstream to Tufts Pond and then about one mile farther via Tufts Brook to the Ashuelot River.

b. Dam. Pisgah Dam has a hydraulic height of 30 feet, is 90 feet long, and 20 feet wide at the crest. The downstream face consists of dry stone masonry and has a slope of 2.5H:8V. The downstream face of the dam bulges locally and the top of the stone masonry at the crest of the dam is convex downstream. (See Appendix C - Figure 2.) One large boulder has fallen out of the downstream facing near the toe of the dam.

The dry stone masonry forms the downstream edge of the crest and the rest of the crest is earth fill which carries an access road. (See Appendix C - Figures 3 and 4.) Part of the crest is covered with grass and part consists of bare soil. It appears that vehicles have been driven along the crest.

Most of the upstream face was not visible as it was beneath the water surface. (See Appendix C - Figures 5 and 6.) In the zone between the water and the crest, brush, having a maximum diameter of about 1½ inches, appears to have been cut recently.

At the contact between the downstream face and the abutments several large trees have been cut recently and are lying against the downstream face of the dam. (See Appendix C - Figure 7.) Cut brush has been dumped on the contact between the downstream face and the abutments.

A large quantity of water is discharging from the toe of the dam at the deepest part of the valley. (Estimated discharge was 3 cfs.) (See Appendix C - Figure 8.) The discharge water was clear. The water may be from seepage or it may be leakage from the gate. Seepage was noted along the west side of the stone masonry. (See Appendix C - Figure 9.)

c. Appurtenant Structures. The available plans dated September 12, 1923 by I.W. Jones & Co. for Pisgah Dam indicate a wooden gate structure on the upstream face. The gate size is shown to be approximately 2.5 feet high by 4 feet wide which was generally confirmed by inspection of the gate outlet on the downstream face of the dam. (See Appendix C - Figure 10.) No gate structure was visible on the upstream face.

The spillway for Pisgah Dam consists of an earth dike east of the main dam. Approximately two inches of water was flowing over the spillway at the time of the inspection. (See Appendix C - Figures 11 and 12.) The downstream face of the spillway consists of a

dry stone masonry wall, the top of which has been mortared. Some cracking and deterioration of the mortared top was noted. The alignment of the crest is irregular, but it is not possible to determine from the visual inspection whether it was constructed this way or whether movements took place after the original construction. The channel upstream of the spillway is wide and unobstructed, and is filled with sand and gravel to the elevation of the upstream edge of the crest. A large pile of logs was observed at the downstream toe of the spillway; most of these logs appear to have come over the spillway. (See Appendix C - Figure 13.) There are also numerous stumps of trees and brush that have been recently cut on the downstream side of the abutments. Trees and brush have been dumped at the contact between the downstream face and the abutments.

In a saddle west of the dam is an earth dike about 3 feet high, 130 feet long, and 13 feet wide at the crest. The upstream and downstream slopes of the dike are vertical dry masonry stone walls. (See Appendix C - Figure 14.) Some bulging was noted locally of the dry masonry wall on the downstream side. The entire dike and the area immediately downstream of the dike have a dense growth of trees, up to about 14 inches in diameter. Minor seepage is occurring at one location near the downstream toe of the dike.

d. Reservoir Area. The watershed above the reservoir is rolling and heavily wooded. (See Appendix C - Figure 15.) No camps or other structures were noted on the shores of the reservoir. No evidence was detected of significant sedimentation in the reservoir.

e. Downstream Channel. The area downstream of the dam is rolling and heavily wooded. The channel downstream of the main dam is narrow. The channel bottom is covered with boulders. Trees and brush overhang the channel. (See Appendix C - Figure 16.) The channel downstream of the spillway is relatively wide and has gentle side slopes. The channel bottom is covered with sand and gravel. Trees and brush overhang the channel. There are many logs in the channel at the downstream toe of the spillway dike. (See Appendix C - Figure 17.) The two downstream channels converge approximately 300 feet downstream of the dam.

3.2 Evaluation

Based on the visual inspection Pisgah Dam appears to be in poor condition.

A major leak or seepage at the base of the main dam could result in a stability problem if not remedied. Irregular alignment of the crest, bulging of the downstream dry stone masonry face, and the fallout of a large boulder from the downstream dry stone masonry face of the main dam appear to indicate a slope stability problem. Large trees have been cut recently at the contact between the downstream face of the dam and the abutments, and the rotting roots of these trees could lead to long-term seepage

problems. Growing brush and piles of cut brush along the downstream toe of the dam make it impossible to adequately inspect the area immediately downstream of the dam.

The presence of large trees growing on the dike west of the main dam and in the area immediately downstream of the dike could lead to long-term stability problems if any of the trees blow over and pull their root masses out or if any of the trees die and their roots rot. The minor seepage downstream of the dike could lead to long-term stability problems if it is not remedied.

The poor alignment of the spillway dike may be evidence of a slope stability problem. Trees and brush have been cut recently at the contact between the downstream slope of the spillway dike and the abutments, and the rotting roots of these trees and the brush could lead to long-term seepage problems. The presence of growing brush and piles of cut brush along these contacts makes it impossible to adequately inspect the area immediately downstream of the dike. The presence of many logs against the downstream face of the dike could result in clogging and damming of the channel during peak spillway discharge, which, in turn, could result in overtopping of the main dam.

The channels downstream of both the main dam and the spillway are overhung by trees. Their presence is undesirable from the standpoint of the possibility that they could clog the channel or downstream culverts during flood discharges.

The gate has no mechanism and is inoperable providing no means of dewatering the reservoir.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

No written operational procedures were disclosed for Pisgah Reservoir Dam. The drain gate is inoperable.

4.2 Maintenance of Dam

New Hampshire Department of Parks and Recreation is responsible for the maintenance of Pisgah Reservoir Dam.

4.3 Maintenance of Operating Facilities

No formal maintenance program was disclosed.

4.4 Description of Any Warning System in Effect

No written warning system was disclosed for Pisgah Reservoir Dam.

4.5 Evaluation

The owner should establish a written operation and maintenance procedure as well as establishing a warning system to follow in the event of emergency conditions. The present maintenance procedures are not adequate to ensure that all problems can be remedied within a reasonable period of time.

SECTION 5
HYDROLOGIC/HYDRAULIC

5.1 Evaluation of Features

a. General. Pisgah Reservoir Dam is a stone masonry gravity dam which impounds a reservoir of small size. Earth fill placed on the upstream side of the dam forms a roadway along the crest. This roadway has only partial vegetative cover and would be susceptible to erosion if overtopped. The spillway consists of an earth dike 100 feet east of the main dam. The downstream face of the spillway consists of a dry stone masonry wall, the top of which has been mortared. This top has undergone some cracking and deterioration. The abutments of the spillway are in natural ground.

b. Design Data. No hydrologic and hydraulic design data were disclosed.

c. Experience Data. According to a letter dated October 13, 1939, the flood of September 21-24 overtopped the main dam by about 1 foot and the wing dam (probably the spillway) by 4 feet.

d. Visual Observations. At the time of inspection, visual evidence of major leakage or seepage near the downstream toe was noted (discharge of 3 cfs estimated). This was noted previously in a memo found in files of the New Hampshire Water Resources Board (NHWRB). (See Appendix B.)

d. Test Flood Analysis. Pisgah Reservoir Dam is classified as being small in size having a hydraulic height of 30 feet and a maximum storage capacity of 950 acre-feet; the dam was determined to have a Significant Hazard Classification. Using Recommended Guidelines for Safety Inspection of Dams, the test flood was determined to be $\frac{1}{2}$ the Probable Maximum Flood (PMF).

To determine the test flood inflow, a CSM value of 2510 was applied to the drainage area of 2.4 square miles. This CSM value was taken off the mountainous curve because the slope of the watershed is in excess of 200 ft/mi. Using $\frac{1}{2}$ the PMF, the test flood inflow was determined to be 3010 cfs (1254 CSM). The test flood discharge after routing was determined to be 2100 cfs (875 CSM). The overtopping analysis indicates that the dam would be overtopped by 1.8 feet during test flood conditions. The maximum spillway capacity at top of dam is 438 cfs which is only 21 percent of the test flood discharge.

f. Dam Failure Analysis. The impact of failure of the dam with the reservoir at top of dam was assessed using the Guidance for Estimating Downstream Dam Failure Hydrographs issued by the Corps of Engineers. The analysis covered the reach extending from the dam to the confluence with the Ashuelot River, a distance of

1.5 miles. A breach at top of dam would increase the stage about 10.2 feet above the antecedent stage of 5.7 feet. The Route 119 crossing is located in this reach, about 1.5 miles downstream of the dam. An analysis of this bridge reflected that during a breach of this magnitude, the road would be overtopped by 4.8 feet. This could result in severe damage to the roadway and erosion and undermining of the land adjacent to the house on the east bank.

A major breach of Pisgah Reservoir Dam probably would not result in the loss of any lives, but could cause appreciable property damage and was therefore classified Significant Hazard.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. The visual examination indicates the following evidence of potential long-term stability problems.

(1) Major seepage or leakage at downstream toe of main dam.

(2) Irregular alignment of the crest of the main dam, bulging of the dry stone masonry downstream face of the main dam, and the fallout of a large boulder from the dry stone masonry downstream face.

(3) Stumps of large trees that have recently been cut near the downstream toe of the main dam.

(4) Minor seepage at the downstream toe of the dike west of the main dam.

(5) Large trees on the dike west of the main dam and in the area immediately downstream of the dike.

(6) Poor alignment of the crest of the spillway dike.

(7) Stumps of trees and brush that have recently been cut at the contacts between the downstream slope of the spillway dike and the abutments.

(8) The absence of the gate operating mechanism and a gate buried under earth and rock fill on the upstream face.

In addition, there are logs in the discharge channel next to the spillway dike and trees overhanging the channels downstream of the main dam and the spillway dike.

Logs and piles of brush at the contact between the downstream face and abutments of both the main dam and the spillway dikes make it impossible to adequately inspect the areas immediately downstream.

b. Design and Construction Data. According to design drawings dated September 21, 1923 the dam consists entirely of stone masonry and is approximately 22 feet wide at the base and 5 feet wide at the top and has an opening 4 feet wide by 2½ feet high located about 10 feet up from the bottom for a discharge opening. According to a letter dated September 21, 1923, the "stone spillway is founded on solid ledge" and "the dam is...founded on solid ledge." The visual inspection alone does not provide information to verify the above statements.

c. Operating Records. According to a letter dated September 21, 1923, "the face of the dam was originally pointed with cement, but after many years a large portion of the pointing has worked out." According to a letter dated October 13, 1938, the flood of September 21-24 overtopped the main dam by about 1 foot and the wing dam (probably the spillway) by 4 feet.

d. Post-Construction Changes. According to a Water Resources Board memorandum dated December 10, 1975, "it would appear that... an earthfill has been placed upstream of the stone structure" (referring to the main dam); "the previous stone spillway appears to have been enlarged in the past from 20-odd feet to its present 80-90 feet;" and "the spillway area has also been backfilled with earth and these fills presently provide road access across the dam." The last statement probably refers to the main dam rather than the spillway dike.

e. Seismic Stability. The dam is located in Seismic Zone 2 and in accordance with the recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7
ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual inspection indicates that the Pisgah Reservoir Dam is in poor condition.

Major concerns with respect to the condition of the dam are:

- (1) Major leakage or seepage at downstream toe of main dam.
- (2) Irregular alignment of the crest of the main dam, bulging of the dry stone masonry downstream face of the main dam, and the fallout of a large boulder from the dry stone masonry downstream face.
- (3) Stumps of large trees that have recently been cut near the downstream toe of the main dam.
- (4) Minor seepage at the downstream toe of the dike west of the main dam.
- (5) Large trees on the dike west of the main dam and in the area immediately downstream of the dike.
- (6) Poor alignment of the crest of the spillway dike.
- (7) Stumps of trees and brush that have recently been cut at the contacts between the downstream slope of the spillway dike and the abutments.
- (8) The absence of a gate operating mechanism and the inoperable gate.

In addition, there are logs in the discharge channel next to the spillway dike and trees overhanging the channels downstream of the main dam and the spillway dike.

b. Adequacy of Information. The information available is such that the assessment of this dam must be based primarily on the visual inspection. The presence of trees, brush, logs, and cut brush at the downstream contact between the main dam and its abutments and at the downstream contact between the spillway dike and its abutments makes it impossible to inspect those areas adequately.

c. Urgency. The recommendations and remedial measures given in Sections 7.2 and 7.3 below should be implemented within one year after receipt of this Phase I inspection report.

d. Need for Additional Investigation. The information available from the visual inspection is adequate to identify the potential problems that are listed in 7.1 a. above. An inspection of the contacts between the downstream face and the abutments of the main dam and the spillway dike should be made after the trees, brush, logs, and cut brush have been removed.

7.2 Recommendations

The owner should engage a Registered Professional Engineer to:

(1) Inspect the contacts between the downstream face and the abutments of the main dam and the spillway dike.

(2) Investigate the seepage or leakage downstream of the main dam and the seepage at the westerly dike.

(3) Evaluate the slope stability of the main dam and the spillway dike.

(4) Design and install an operable drain gate.

7.3 Remedial Measures

a. Operating and Maintenance Procedures. The owner should:

(1) Clear and keep the dam and dike clear of trees, brush, and remove stumps and roots of trees that have been previously cut and backfill properly.

(2) Keep the area for a distance of 25 feet downstream of the dam, westerly dike, and spillway dike free of trees, brush, and root systems and backfill properly.

(3) Keep the banks of the discharge channels downstream of the main dam and spillway dike free of trees, brush, and root systems for a distance of about 25 feet on either side of the channel for about 100 feet of channel immediately downstream of the dam and spillway dike.

(4) Visually inspect the dam and appurtenant structures once each month.

(5) Engage a Registered Professional Engineer to make a comprehensive technical inspection of the dam once every year.

(6) Establish a surveillance program for use during and immediately following periods of heavy rainfall and also a warning program to follow in case of emergency conditions.

7.4 Alternatives

None recommended.

APPENDIX A
VISUAL INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST
PARTY ORGANIZATION

PROJECT Pisgah Reservoir Dam, NH DATE December 1, 1978;
May 2, 1979

TIME 0900; 0900

Clear, cold;

WEATHER Clear, cool

PARTY: December 1, 1978

| | | |
|--------------------|----------------|----------------|
| W.S. ELEV. | U.S. | DN.S. |
| | <u>875.9';</u> | <u>850.3';</u> |
| <u>May 2, 1979</u> | <u>878'</u> | <u>850.3'</u> |

- | | |
|--------------------------------|------------------------------|
| 1. <u>Warren Guinan</u> | 6. <u>Warren Guinan</u> |
| 2. <u>Stephen Gilman</u> | 7. <u>Stephen Gilman</u> |
| 3. <u>Robert Ojendyk</u> | 8. <u>Robert Ojendyk</u> |
| 4. <u>Katherine Somerville</u> | 9. <u>Pattu Kasavan</u> |
| 5. <u>Ronald Hirschfeld</u> | 10. <u>Ronald Hirschfeld</u> |

| PROJECT FEATURE | INSPECTED BY | REMARKS |
|--------------------------------|--------------------------------|---------|
| 1. <u>Hydrology/Hydraulics</u> | <u>W. Guinan/K. Somerville</u> | |
| 2. <u>Structural Stability</u> | <u>S. Gilman</u> | |
| 3. <u>Soils and Geology</u> | <u>R. Hirschfeld</u> | |
| 4. _____ | _____ | _____ |
| 5. _____ | _____ | _____ |
| 6. _____ | _____ | _____ |
| 7. _____ | _____ | _____ |
| 8. _____ | _____ | _____ |
| 9. _____ | _____ | _____ |
| 10. _____ | _____ | _____ |

PERIODIC INSPECTION CHECKLIST

December 1, 1978

PROJECT Pisgah Reservoir Dam, NHDATE May 2, 1979PROJECT FEATURE Dam Embankment

NAME _____

DISCIPLINE _____

NAME _____

AREA EVALUATED

CONDITION

DAM EMBANKMENT

| | |
|---|---|
| Crest Elevation | 880.5' MSL |
| Current Pool Elevation | 878' MSL |
| Maximum Impoundment to Date | Unknown |
| Surface Cracks | None apparent |
| Pavement Condition | Not paved |
| Movement or Settlement of Crest | Boulders on downstream edge of crest not aligned straight |
| Lateral Movement | Downstream face bulges downstream |
| Vertical Alignment | Good |
| Horizontal Alignment | See "Movement or Settlement of Crest" above |
| Condition at Abutment and at Concrete Structures | Large trees growing at contact between downstream face and both abutments. Trees were cut recently. |
| Indications of Movement of Structural Items on Slopes | None apparent |
| Trespassing on Slopes | None apparent |
| Sloughing or Erosion of Slopes or Abutments | None apparent, except for cut trees |
| Rock Slope Protection - Riprap Failures | Downstream rock face bulges downstream |
| Unusual Movement or Cracking at or Near Toe | Large rock has fallen out of downstream face near toe |
| Unusual Embankment or Downstream Seepage | Large seepage discharging from downstream toe |
| Piping or Boils | None apparent |
| Foundation Drainage Features | None apparent |
| Toe Drains | None apparent |
| Instrumentation System | None apparent |
| Vegetation | Brush up to 1½"-dia. recently cut on upstream slope; large trees up to about 12"-dia. recently cut on abutment close to contact with downstream face. |

PERIODIC INSPECTION CHECKLIST

December 1, 1978

May 2, 1979

PROJECT Pisgah Reservoir Dam, NH

DATE _____

PROJECT FEATURE West Dike

NAME _____

DISCIPLINE _____

NAME _____

| AREA EVALUATED | CONDITION |
|---|--|
| <u>DIKE EMBANKMENT</u> | |
| Crest Elevation | 881' MSL |
| Current Pool Elevation | 878' MSL |
| Maximum Impoundment to Date | Unknown |
| Surface Cracks | None apparent |
| Pavement Condition | Not paved |
| Movement or Settlement of Crest | None apparent |
| Lateral Movement | None apparent |
| Vertical Alignment | Good |
| Horizontal Alignment | Good |
| Condition at Abutment and at Concrete Structures | Good |
| Indications of Movement of Structural Items on Slopes | Some bulging of dry masonry on downstream face |
| Trespassing on Slopes | None apparent |
| Sloughing or Erosion of Slopes or Abutments | None apparent |
| Rock Slope Protection - Riprap Failures | Some bulging of dry masonry on downstream face |
| Unusual Movement or Cracking at or Near Toes | None |
| Unusual Embankment or Downstream Seepage | Seepage near downstream toe |
| Piping or Boils | None apparent |
| Foundation Drainage Features | None apparent |
| Toe Drains | None apparent |
| Instrumentation System | None apparent |
| Vegetation | Many trees, up to 14"-dia., on crest of dike and near downstream toe |

PERIODIC INSPECTION CHECKLIST

December 1, 1978

PROJECT Pisgah Reservoir Dam, NH

DATE May 2, 1979

PROJECT FEATURE Spillway Dike

NAME _____

DISCIPLINE _____

NAME _____

| AREA EVALUATED | CONDITION |
|--|---|
| <u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u> | |
| a. Approach Channel | Pisgah Reservoir |
| General Condition | Good |
| Loose Rock Overhanging Channel | None |
| Trees Overhanging Channel | None |
| Floor of Approach Channel | Sand and gravel accumulated to upstream edge of crest. |
| b. Weir and Training Walls | D/S face - stone masonry, crest - deteriorated mortar. |
| General Condition of Concrete | Not applicable |
| Rust or Staining | Not applicable |
| Spalling | Not applicable |
| Any Visible Reinforcing | Not applicable |
| Any Seepage or Efflorescence | Not applicable |
| Drain Holes | None |
| c. Discharge Channel | |
| General Condition | Poor |
| Loose Rock Overhanging Channel | None |
| Trees Overhanging Channel | Many |
| Floor of Channel | Sand and gravel |
| Other Obstructions | Many logs and debris are deposited against downstream face of spillway and in downstream channel. |

PERIODIC INSPECTION CHECKLIST

PROJECT Pisgah Reservoir Dam, NH

December 1, 1978
DATE May 2, 1979

PROJECT FEATURE Outlet Structure and Channel

NAME _____

DISCIPLINE _____

NAME _____

| AREA EVALUATED | CONDITION |
|---|---|
| <u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u> | |
| General Condition of Concrete | None - Stone masonry discharge opening - no evidence of movement |
| Rust or Staining | |
| Spalling | |
| Erosion or Cavitation | |
| Visible Reinforcing | |
| Any Seepage or Efflorescence | |
| Condition at Joints | |
| Drain holes | None |
| Channel | |
| Loose Rock or Trees Overhanging Channel | Many trees overhanging channel |
| Condition of Discharge Channel | Bouldery, some logs |

PROJECT Pisgah Reservoir Dam

DATE December 1, 1978
May 2, 1979

PROJECT FEATURE Reservoir

NAME K. Somerville

| AREA EVALUATED | REMARKS |
|--|---|
| Stability of Shoreline | Good |
| Sedimentation | Not visible |
| Changes in Watershed Runoff Potential | None |
| Upstream Hazards | Many seasonal structures around perimeter of reservoir |
| Downstream Hazards | Several inhabited structures and Route 119 |
| Alert Facilities | None posted |
| Hydrometeorological Gages | None |
| Operational & Maintenance Regulations | None posted |

APPENDIX B
ENGINEERING DATA

Dam No. 255.11- Pisgah Reservoir, Winchester

Visual Discrepancies:

- 1-a Numerous large trees growing very near the dam and spillway.
- b Small trees and bushes growing on top of the dam.
- c Several seedling trees growing directly out of the stonework.

All tree growth within fifteen (15) feet of the dam should be removed and the stumps chemically treated to prevent regrowth. The root structures of these trees contribute to the continued deterioration of the dam. They displace stones and cause leakage. The small trees growing directly out of the dam will cause substantial damage if left to grow.

- 2- There is substantial leakage through the dam which exits at the very bottom on the downstream side. This leakage should be stopped to prevent ice damage to the stonework.
- 3- The gate is completely inoperational due to deterioration and earth backfill. This should be repaired so that the water level can be lowered for occasional maintenance of the upstream face.

KS:paf
12/17/78

NEW HAMPSHIRE WATER RESOURCES BOARD

INSPECTION REPORT

Town: WINCHESTER Dam Number: 255.11
Name of Dam, Stream and/or Water Body: PISGAH RESEVOIR
Owner: DIVISION OF PARKS Telephone Number: _____

Mailing Address: _____

Max. Height of Dam: 32' Pond Area: 64 ACRES Length of Dam: 90'

FOUNDATION: LEDGE

OUTLET WORKS: STONE SPILLWAY W/ MORTARED CREST ON D/S SIDE
LEDGE ABUTS.
SEVERAL LARGE TREES GROWING JUST D/S ESPECIALLY
1 OAK + 1 MAPLE (SOME SMALL TREES ON TOP @ RIGHT END
STANDING WATER AT TOE BUT NO APPARENT
SEEPAGE

ABUTMENTS: ~~STONE~~ STONE DAM W/ LEDGE ABUTS
MANY SMALL TREES ^{+ BUSHES} GROWING ON TOP OF DAM.
SEVERAL LARGE TREES GROWING ON D/S LEDGE
VERY NEAR DAM
SOME SAPLINGS GROWING OUT OF STONework

ENTRANCE: GATE CLOSED OFF W/ EARTH FILL

SPILLWAY: Length: _____ Freeboard: _____

SEEPAGE: Location, estimated quantity, etc.

1 TO 2 CFS AT EXTREME TOE OF DAM

Changes Since Construction or Last Inspection:

TREES STILL GROWING

Tail Water Conditions:

FREE FLOWING

LOGS FROM LAKE JUST D/S OF SPILLWAY

Overall Condition of Dam: FAIR

Contact With Owner: NO

Date of Inspection: 10/2/78

Suggested Reinspection Date _____

Class of Dam: NON-MENACE

Signature Kenneth Stern

Date 10/2/78

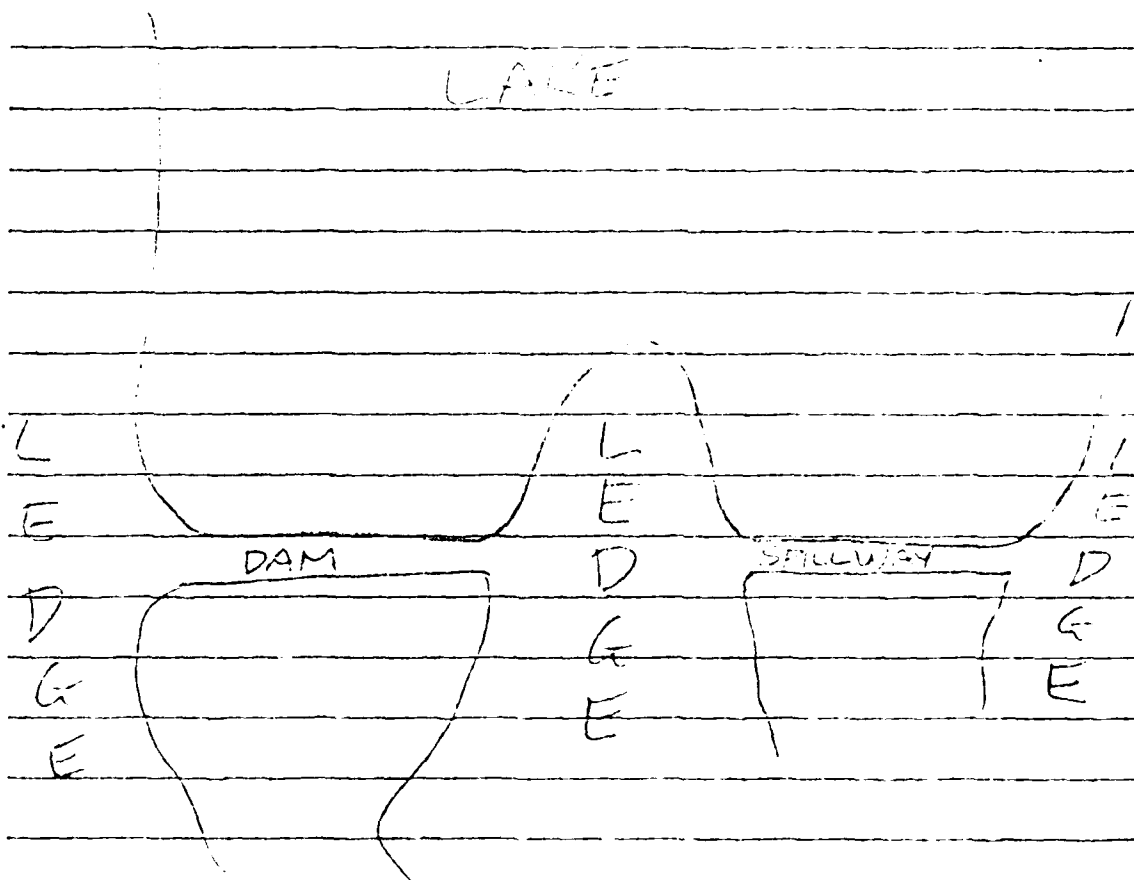
COMMENTS:

① CUT ALL TREES WITHIN 15' OF D/S FACE

APPROX 10 MAYBE MORE MAJOR TREES

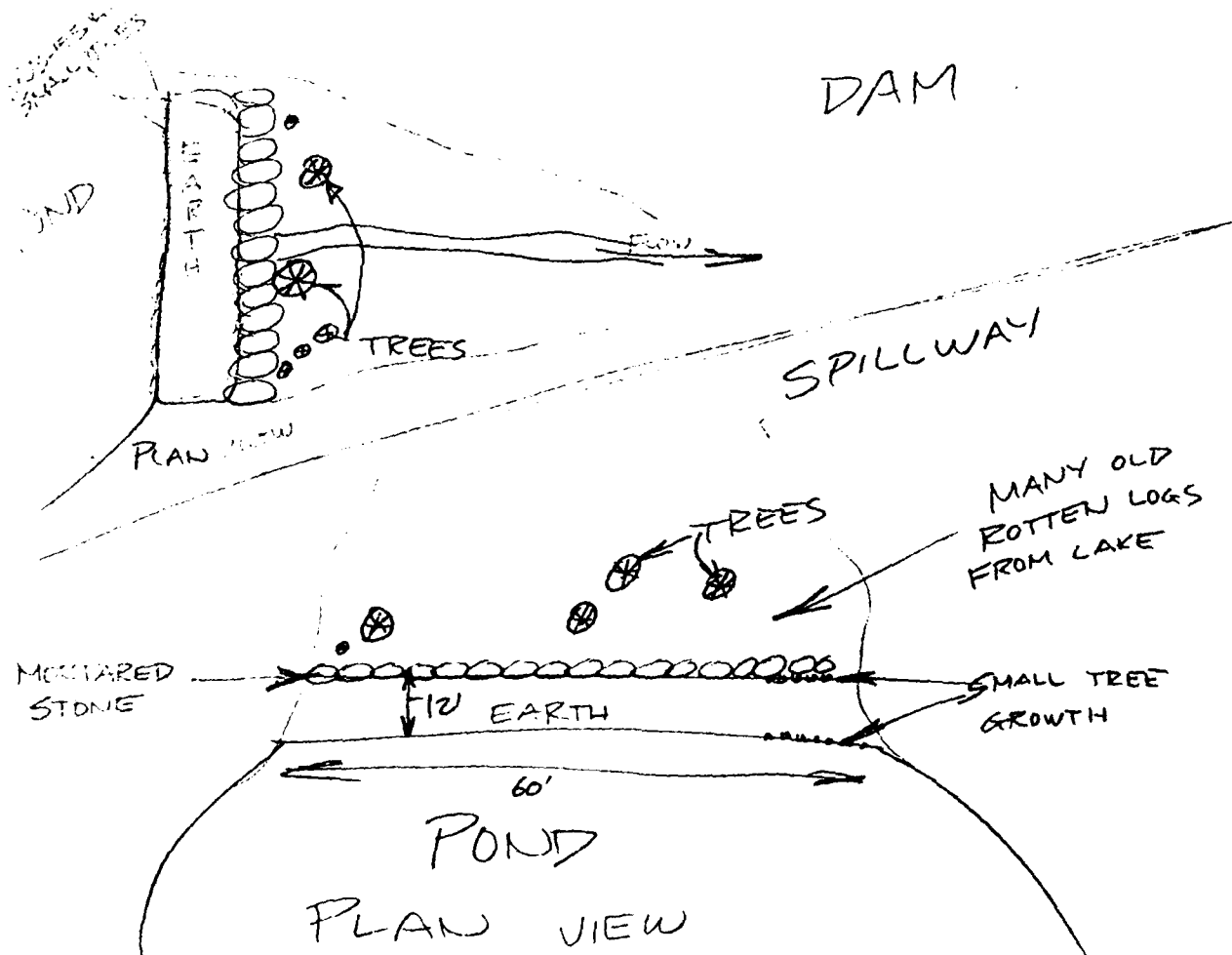
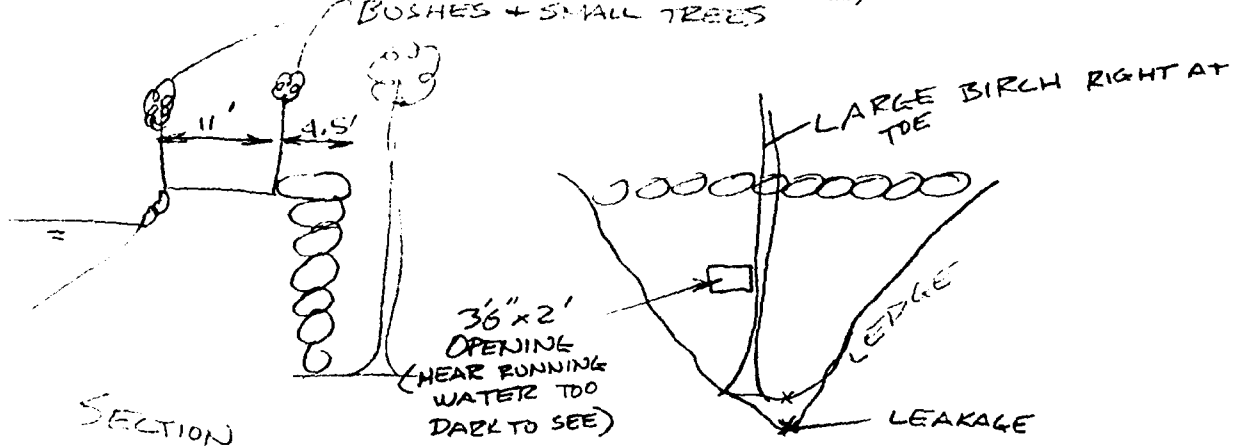
MANY MINOR TREES

② ALL STREAM FLOW (1 TO 2 CFS) IS LEAKAGE
AT VERY BOTTOM TOE OF DAM



SKETCH OF DAM

(Show Plan, Elevation & Cross Sections)
BUSHES + SMALL TREES



WATER RESOURCES BOARD

37 Pleasant Street
Concord, N.H. 03301

TELEPHONE 271-346

October 17, 1978

Mr. George T. Hamilton, Director
Division of Parks and Recreation
State House Annex
Concord, New Hampshire 03301

Dear Mr. Hamilton:

Under the provisions of RSA Chapter 482, Sections 8 through 15, the New Hampshire Water Resources Board is authorized to inspect all dams in the State which by reason of their physical condition, height and location may be a menace to the public safety.

The dam structure (No. 255.11) located in Winchester - Pisgah.
Reservoir was inspected on October 2, 1978
and as a result of this inspection, certain discrepancies were found which should require corrective measures in order to protect the integrity of the structure. (See attached sheet.)

Your dam has been classified by the Board as a non-menace dam and with this classification, the State will not insist that the item(s) noted on the attached be corrected, but it is advisable that corrective measures be voluntarily initiated to protect the integrity of the structure.

Should you make the repairs and/or maintenance items on the attached sheet in the waters of the State, you will need a permit from the Special Board. Applications can be obtained by writing or calling the Special Board Office, 37 Pleasant Street, Concord, New Hampshire 03301, telephone no. 271-2147.

Please feel free to call or write if you have any questions regarding the evaluation of your structure.

Sincerely,

George M. McGee, Sr.
George M. McGee, Sr.,
Chairman

GMH:paf
Enc.

cc:

LIVE FREE OR DIE

NEW HAMPSHIRE WATER RESOURCES BOARD

DAM INVENTORY FOR TOWN OF WINCHESTER # 255

| DAM # | OWNER'S NAME | MAILING ADDRESS | NAME OF WATERBODY |
|-------|--|--|---------------------------------------|
| .01 | Ashuelot Paper Co. | <i>Hinsdale N. H.</i> | Ashuelot River |
| .02 | Public Service Co. | <i>Manchester N. H. 1000 Elm St.</i> | Ashuelot River - Robertson Dam |
| .03 | Public Service Co. | <i>1000 Elm St. Manchester N. H.</i> | Ashuelot River Upper Robertson Dam |
| .04 | Hampshire Woolen Co. | <i>not known where may be gone</i> | Ashuelot River |
| .05 | | | |
| .06 | | | Roaring Brook |
| .07 | Forest Lake Improvement Assoc. Inc. 48 Oak Grove Avenue Brattleboro, Vt. | <i>William A. Mc. Smith 22 Longwood St. Winchester Ct. 06045</i> | Forest Lake |
| .08 | | | Broad Brook |
| .09 | Hinsdale Water Works | <i>Town of Hinsdale Hinsdale N. H.</i> | Kilburn Pond |
| .10 | Ansel Dickenson & Sons | <i>Dunning Corp Walpole N. H.</i> | Ashuelot River |
| .11 | XXXXXXXXXXXXXXXXXXXX DRED - State of NH | | Pisgah Reservoir |
| .12 | Mr. Acilio Sandri 4 Cherry St. Greenfield, Mass. | <i>R.F.D. 2 Winchester N. H.</i> | |
| .13 | Ashuelot Paper Co. | <i>P.O. Box Hinsdale N. H. 03451</i> | Tufts Brook |
| .14 | Rev. Jerome H. Wood 8 Holton Street East Northfield, Mass. | <i>same address</i> | |
| .15 | Davis & Symonds Lumber Co. Bowen Street Claremont, NH | <i>same address B-7</i> | |

RECEIVED

JUL 2 1976
NEW HAMPSHIRE
WATER RESOURCES BOARD

| NO. | OWNER | ADDRESS | NAME OF DAM OR WATER BODY | CONDITION | CLASSIFICATION | DATE INSPECTED | OWNER NOTIFIED | REMARKS |
|-----|-------------------------------|--|---------------------------|-----------|----------------|----------------|----------------|---------|
| 1 | ASHUELLOT PAPER CO | HINSDALE NH | ASHUELLOT R. | FAIR | NON-M | 9/22/78 | 9/25/78 | |
| 2 | PAPER SERVICE MILLS | HINSDALE NH | ASHUELLOT R. | FAIR | NON-M | 9/22/78 | 9/25/78 | |
| 3 | | | | RUINS | | 10/18/78 | N/A | |
| 4 | | | | RUINS | | | N/A | |
| 5 | GOOD FILL | | | RUINS | | 10/18/78 | N/A | |
| 6 | | | | RUINS | | | N/A | |
| 7 | FOREST LAKE RECREATION ASSOC. | WINCHESTER NH | FOREST LAKE | GOOD | NON-M | 12/8/76 | N/A | Current |
| 8 | | | | RUINS | | | N/A | |
| 9 | John J. Shaker | Winchester | Freeman Pond | | | | | |
| 10 | TRAFLET BROWN CORP. | Box 9A RFD 3 PLYMOUTH | ASHUELLOT R. | FAIR | NON-M | 9/22/78 | 10/3/78 | |
| 11 | 114 DU DE PARKS | | PISCAN RES | FAIR | MEMACE | 10/2/78 | 10/3/78 | |
| 12 | LEUNG CAUDRI | STONE MT RD WINCHESTER | NO NAME | GOOD | NON-M | 10/2/78 | 10/3/78 | |
| 13 | | | | NOT PAULT | | 10/9/78 | N/A | |
| 14 | RENTON WOOD | 8 HOLTON ST EAST NORTHFIELD MA | | GOOD | NON-M | 12/1/76 | N/A | Current |
| 15 | | | | RUINS | | 10/10/78 | N/A | |
| 16 | BERNARD MEADOW | 55 E 87 ST NY NY 10028 | Yonkers Pond | GOOD | NON-M | 12/1/76 | N/A | Current |
| 17 | KEENEITH SMITH | 7642 LORELO AVE PHILA PA 19111 | | GOOD | NON-M | 12/1/76 | N/A | Current |
| 18 | NORMAN GALASSIO | 22 KELSEY ST WILMINGTON CONN | NO NAME | FAIR | NON-M | 10/2/78 | 10/3/78 | |
| 19 | AM V. GORDON | 1055 AVOON BLVD CHESHIRE CONN 06810 | | | NON-M | | | |

Page

of

VENACE 1 & NON-VENACE 10

= TOTAL ACTIVE DAMS

RUINS

not built -

DAMS IN

Winchester

NHWRB # 255

| DAM NO. | OWNER | ADDRESS | NAME OF DAM OR WATER BODY | CONDITION | CLASSIFICATION | DATE INSPECTED | OWNER NOTIFIED | REMARKS |
|---------|--------------------------------|---|-----------------------------|-----------|----------------|----------------|----------------|----------------------------|
| 1 | Ashuelot Paper Co. | | Ashuelot River | | | | | ** To high to inspect |
| 2 | Ashuelot Paper Co. | | Ashuelot River | | | | | ** Reinspect in Summer '77 |
| 3 | Ashuelot Paper Co. | | Ashuelot River | | | | | ** |
| 4 | Ashuelot Paper Co. | | Ashuelot River | Ruins | | Dec. 1, '76 | - | |
| 5 | Ashuelot Paper Co. | | Mirey Br. | Ruins | | Dec. 8, '76 | - | |
| 6 | Ashuelot Paper Co. | | Roaring Br. | Ruins | | Dec. 8, '76 | - | |
| 7 | Forest Lake Improvement Assoc. | Winchester | Forest Lake | Good | | Dec. 8, '76 | - | |
| 8 | Forest Lake Improvement Assoc. | Winchester | Broad Br. | Ruins | | Dec. 1, '76 | - | |
| 9 | Hindsdale Water Works | Hindsdale | <i>Pool</i> Kilburn Road | | | | | ** |
| 10 | New England Box Co. | Greenfield | Ashuelot River | | | | | Water to high |
| 11 | State of N. H. Parks Dept. | Concord | Pisgah Res. | Good | | | | |
| 12 | Acilio Sandri | 4 Clerry St. Greenfield, Ma. | No Name | - | | | - | - |
| 13 | Ashuelot Paper | | Taft Br. | | | | | ** |
| 14 | Rev. Jerome H. Wood | 8 Holton Street East Northfield, Ma. | | Good | Non-Menace | Dec. 1, '76 | | |

Page

MENACE

& NON-MENACE

= TOTAL ACTIVE DAMS

RUINS

of

** To be inspected in 1977

Division of Resources Lands
Page three

for improved pond level
control.

4) Concrete sill under foot
bridge is deteriorated
and as such probably
causes leakage.

5) Several small depressions
or sluff areas in the
embankment need to be
filled in.

Pillsbury St. Park - Carley Pond
(245.13)
- North Pond
(245.14)
Butterfield Dam
May Pond - (245.10)

Ruins

Reconstruct Dam

Ruins

Reconstruct Dam

- 1) Repair concrete spill-
way cap which was a hole
in it.
- 2) Reconstruct gate and
lifting apparatus to
operational status again.

- 1) Repair rock fill
portion of dam between
gate section and road.
This portion has
settled or eroded and
needs to be raised to
top of concrete plat-
form.
- 2) Repair concrete facing
of abutments or patch
as required to repair
general deterioration

Pisgah Park - Reservoir (255.11)

Please refer to letter
dated Dec. 10, 1975
directed to George T.
Hamilton, Director

- - -

Fullam Pond (45.09)

- 1) Remove debris from
spillway
- 2) Cleanout downstream
channel

- 1) For all practical
purposes reconstruct
the dam and utilizing
existing stone struc-
ture where possible

Russell- Abbott - Pratt Pond A.
(154.01)

Transferred to Water Re-
sources Board

Silver Lake Park - Silver Lake Dam
(119.06)

- 1) Remove sand fill that is
against the stoplogs

- 2) Increase length of
spillway. For details
please refer to the
letter dated Nov. 2
1976.

STATE OF NEW HAMPSHIRE

INTER-DEPARTMENT COMMUNICATION

FROM **GEORGE M. MCGEE, SR.**
Chairman

DATE **December 10, 1975**
AT (OFFICE)

SUBJECT **Inspection of Dam #255.11**
Pisgah Reservoir

Water Resources Board
37 Pleasant Street
Concord, N. H.

TO
GEORGE T. HAMILTON, Director
Division of Parks

On November 21st, 1975, an engineer of this office accompanied by Mr. Parker of your staff inspected the stone dam at Pisgah Reservoir in Winchester, N. H. for the purpose of determining what repairs might be required by your department to place this dam in safe operating condition.

Following the inspection the staff reviewed the inspector's report and plans of the structure on file in this office and have found that there is considerable leakage under the 32' high stone dam. The gate section is inoperable and it would appear that an attempt to stop the leakage by an earthfill has been placed upstream of the stone structure. The previous stone spillway appears to have been enlarged in the past from 20-odd feet to its present 80 - 90 feet which improves the discharge capacity of this dam.

The spillway area has also been backfilled with earth and these fills presently provide road access across the dam.

Except for the leakage and the inoperable gate, the structure appears to be sound and has sufficient spillway capacity to handle floods of record.

We were led to believe that the leakage has resulted in a drop of water level in some instances as much as 4 to 5' which prompts us to request your office to verify this condition and to indicate whether or not such a condition during a rare drought period would be detrimental to your park operation.

A satisfactory repair of this leakage would involve draining the pond, removing the backfill material, and placing a concrete curtain wall against the original stone structure. Access to this site is quite limited and a new access road for equipment and concrete trucks might have to be constructed, all of which would indicate a sizeable cost for the reconstruction of this dam for the purpose of shutting off leakage. We anticipate no other reason for making these repairs at this time.

We would appreciate your department's position regarding the above at your earliest convenience.

GMM/VAK:Lb

DATE: August 1, 1969

FROM: Francis C. Moore
Water Resources Engineer

SUBJECT: Pisgah Reservoir, Winchester

TO: George M. McGee, Sr. *8/11/69*
Chairman, N. H. Water Resources Board

On July 30, 1969, I inspected Pisgah Reservoir, Dam No. 255.11, with Jack Heath of Resources Development Division. This dam has a downstream masonry face about 32 feet high and 108 feet long with a earth fill upstream for a roadway at times of relatively low water.

This dam leaks considerably at two points near the base of the dam (downstream). No fines were observed in the flow. The water apparently runs through the fill and masonry from both sides of the low point. It appears to be no menace. Another considerable flow was observed coming through the toe of the masonry wall about four or five feet from top of masonry near the east end of dam. This water could be heard running through the masonry wall. This flow is clear and has little head, appearing to be no menace.

Water at time of observation was about one foot below top of masonry. There had been rain for nearly four days previous to inspection with at least 4 inches precipitation.

The gate section is located about ten to twelve feet above bottom of dam and had no flow. Apparently, the gate is completely sealed with earth. This gate is completely inoperable.

The spillway is located about 200 feet east of the east end of dam. It is masonry. Logs and debris raised the reservoir level about one foot. The water was about 18 inches above the masonry spillway. The whole spillway of dry rubble mortared is about 90 feet long with about 30 feet at the 1 1/2 foot depth from water surface with the balance just above water surface with some flow through it. There is a roadway of sorts upstream of spillway. This spillway appears safe at present.

Recommendations:

1. All trees and brush should be removed from the spillway and dam and downstream for a short distance.
2. Debris and logs upstream of the spillway should be removed.
3. The spillway should be leveled off at the elevation of the 30'± deep section by removing higher stones. Then the surface of the 90' level spillway section should be pointed up or a concrete cap placed at the elevation of the present, 30' section.
4. The dam could be, but not necessarily, capped with concrete about 12" above the lowest point in the present dam. The cap should extend down four or five feet from top of dam on the upstream face.

Pisgah Reservoir, Winchester
August 1, 1969
Page 2.

Actual cost of needed repairs would not be expensive. About \$5,000 should accomplish the first three items listed.

This 24 square-mile drainage area would pass 220 cfs once in 15 years and 460 cfs once in 100 years.

FCM/jb

STATE OF NEW HAMPSHIRE

INTER-DEPARTMENT COMMUNICATION

DATE July 16, 1969
FROM Russell B. Tobey, Director
Division of Parks
AT (OFFICE) Resources and Economic
Development

SUBJECT

TO George McGee
Water Resources

RECEIVED

JUL 18 1969

NEW HAMPSHIRE
WATER RESOURCES BOARD

Dear George:

The proposed Pisgah Wilderness State Park is in the land acquisition phase. One of the properties is that of the Dickinson Real Estate and Lumber Company in Winchester. They own the Pisgah Reservoir, a 100 odd acre body of water just north of Ashuelot. This body of water is maintained at its present level by two dams constructed over a hundred years ago.


I would very much like to have your engineers look these dams over from the point of view of their safety. Also I would like to have some recommendations on needed maintenance to put them in safe operating condition.

Jack Heath of the Resources Development Division can furnish you with maps and photographs, and will be willing to go with your engineers if this is desirable.

The road into the Reservoir is kept locked, and a key may be obtained from Dubriske's Store near the entrance.

Sincerely yours,

CNH/arr


Russell B. Tobey
Director of Parks

*Very
Schedule as soon
as possible
S.M.*

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON DAMS IN NEW HAMPSHIRE

LOCATION

STATE NO. 255.11
Town Winchester : County Cheshire
Stream Pisgah Reservoir
Basin-Primary Conn. R. : Secondary Ashuelot R. Tufts Brook
Local Name
Coordinates—Lat. : Long.

GENERAL DATA

Drainage area: Controlled Sq. Mi.: Uncontrolled Sq. Mi.: Total 2.5 Sq. Mi.
Overall length of dam 108 ft.: Date of Construction repaired 1923
Height: Stream bed to highest elev. 32 ft.: Max. Structure 28 ft.
Cost—Dam : Reservoir

DESCRIPTION Masonry—Granite blocks and cement.

Waste Gates

Type
Number 1 : Size 2.5 ft. high x 4 ft. wide
Elevation Invert 14 : Total Area sq. ft.
Hoist

Waste Gates Conduit

Number : Materials
Size ft.: Length ft.: Area sq. ft.

Embankment

Type
Height—Max. ft.: Min. ft.
Top—Width : Elev. ft.
Slopes—Upstream on : Downstream on
Length—Right of Spillway : Left of Spillway

Spillway

Materials of Construction natural ledge
Length—Total 26 ft.: Net ft.
Height of permanent section—Max. 28 ft.: Min. ft.
Flashboards—Type : Height ft.
Elevation—Permanent Crest : Top of Flashboard
Flood Capacity cfs.: cfs/sq. mi.

Abutments

Materials:
Freeboard: Max. 4.0 ft.: Min. ft.

Headworks to Power Devel.—(See "Data on Power Development")

OWNER Dickinson Land & Lumber Co.

REMARKS

Use—Industrial Storage
Condition—unknown

Tabulation By RL¹ B-15 Date 9/27/39
B&H21284

**NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON RESERVOIRS & PONDS IN NEW HAMPSHIRE**

LOCATIONAT DAM NO. 255.11Town Winchester : County CheshireStream Pisgah ReservoirBasin—Primary Conn. R. : Secondary Ashuelot R. Tufts Brook

Local Name

DRAINAGE AREAControlled Sq. Mi.: Uncontrolled Sq. Mi.: Total 2.5 Sq. Mi.**ELEVATION vs. WATER SURFACE AREA vs. VOLUME**

| Point | Head Feet | Surface Area Acres | Volume Acre Ft. |
|------------------------|--------------|--------------------------|--------------------|
| (1) Max. Flood Height | | | |
| (2) Top of Flashboards | | | |
| (3) Permanent Crest | | | |
| (4) Normal Drawdown | | <u>63.69</u> | |
| (5) Max. Drawdown | | | |
| (6) Original Pond | | | |

Base Used: Coef. to change to U.S.G.S. Base

RESERVOIR CAPACITY

| | Total Volume | Useable Volume |
|----------------------|--------------|----------------|
| Drawdown |ft. |ft. |
| Volume |ac. ft. |ac. ft. |
| Acre ft. per sq. mi. | | |
| Inches per sq. mi. | | |

USE OF WATER Industrial (Storage)OWNER Dickinson Lumber Co.REMARKS Condition not knownTabulation By RLT B-16 Date 9/27/39

DAIR

REMARKS Location unknown estimated by Stationer
42 in. Tall small, delicate

POWER DEVELOPMENT

[illegible]REMARKS Reading under supervision - L. W. Jones, Engineer & Pilot

DATE _____

NEW HAMPSHIRE WATER CONTROL COMMISSION

Dams on Which Information is Available in the

Town of Winchester

| State No. | Location Stream | Name of Body of Water Created | Owner | Condition |
|-----------|-------------------|-------------------------------|------------------------------------|-----------|
| 255.01 | Ashuelot River | ---- | Ashuelot Paper Co. | Operable |
| 255.02 | " " | ---- | Pub. Ser. Co. of N.H. | " |
| 255.03 | " " | ---- | " " " " | " |
| 255.04 | " " | ---- | " " " " | Ruin |
| 255.05 | Mirey Brook | ---- | Mr. Cromby | " |
| 255.06 | Roaring Brook | ---- | Geo. Holton | " |
| 255.07 | Forest Lake Brook | Forest Lake | Davis & Crowley | Operable |
| 255.08 | Broad Brook | ---- | Dickinson Real Estate & Lumber Co. | Ruin |
| 255.09 | Kilburn Brook | Kilburn Pond | Hinsdale Water Works | Operable |
| 255.10 | Ashuelot River | ---- | Ansel Dickinson Sons | " |
| 255.11 | Tufts Brook | Pisgah Reservoir | Dickinson Real Estate & Lumber Co. | " |

Rec'd 10/21/29

WATER CONTROL COMMISSION

STATE OF NEW HAMPSHIRE

Concord, New Hampshire

October 18, 1929.

| | |
|-----------|---|
| Jacobson | |
| Holmgren | ✓ |
| Colburn | |
| | |
| | |
| Return to | |
| Filed | |
| File No. | |

Dickinson Lumber & Lumber Co.,
Winchester, N H

RE: Piscataqua Reservoir Dam. W. C. C. No. 255.11

Gentlemen:

In order that we may determine the magnitude and extent of the flood of September 21-22 just passed, we are requesting the various dam owners in the State to supply us with the following information:

1. Was this dam injured? Ans. No.
2. If so, to what extent? Ans. _____
3. Did all flashboards go out? Ans. No flashboards on dam
4. What was the maximum height of water over the permanent crest of spillway? Ans. About 1 ft over main dam and 4 ft over small wing.
5. At what day and hour did the maximum flood height reach your dam? Ans. Sept. 22 - 4 PM. Small drainage area and high tide.
6. Any other interesting information regarding the flood or rain fall may be given on the back of this sheet, or attach sheets.

Will you please return this letter with as much information as you can give us as promptly as possible. A self-addressed envelope is attached hereto.

We thank you for your cooperation.

Very truly yours,

Richard L. Holmgren
Chief Engineer

CDC:GMB
Enc.

DAMS IN THE TOWN OF Winchester

| DAM NO. | LAST KNOWN OWNER | LAST KNOWN ADDRESS | USE | NAME OF DAM OR WATER |
|---------|---|-------------------------------|-------------------------------|----------------------|
| 1 | Ashuelot Paper Company | Hinsdale | Industrial | ? |
| 2 | Public Service Co. of N.H. (Robertson Bros. Lessees) | | " | Robertson Dam |
| 3 | " | | " | U |
| 4 | Hampshire Woolen Company | | " | Upper Robertson Dam |
| 5 | ? | | | |
| 6 | George Holton | | | Holton's Dam |
| 7 | Forest Lake Improvement Assoc | Winchester | Power for Mill | Forest Lake |
| 8 | Dickinson Real Estate & Lumber Co. | | Recreation | |
| 9 | Hinsdale Water Works | | Ruins | |
| 10 | New England Box Company | Greenfield, Mass. | Water Supply | Kilburn Pond |
| 11 | Dickinson Land & Lumber Co. | | Industrial | |
| 12 | Acilio Sandri | 4 Cherry St. Greenfield, MA | " | Pisgah Pond |
| 13 | Ashuelot Paper | Hinsdale | Recreation & Fire Prot. (SCS) | Sandri Pond |
| 14 | Rev. Jerome H. Wood | 8 Holton St. E. Northfield MA | Industrial | |
| 15 | Davis & Symonds Lumber Co. | Box 56, Claremont NH | Recreation & Fire Pond (SCS) | |
| 16 | Dr. Herbert Meadow | Old Curtis Rd, Winchester | ? Recreation Pond | No name stream |

SURVEYS,
PLANS AND
ELEVATIONS
FOR
DAMS,
PULP AND
PAPER
MILLS,
ELECTRIC
POWER
PLANTS,
ETC.

I. W. JONES & CO.



ENGINEERS AND DESIGNERS OF WATER POWER PLANTS

RECEIVED
SEP 22 1923
TELEPHONE CONNECTION

REFERENCE

MILTON, NEW HAMPSHIRE

, September 21, 1923

Public Service Commission,

Concord, N.H.

Gentlemen:

As suggested by you recently, I visited the storage dam owned by the New-England-Box-Company ~~xxx~~ located on "Pisgah" Mountain about two miles from Ashuelot Village on a Stream entering Ashuelot River at one mile down stream from Ashuelot Village.

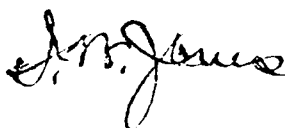
The dam is approximately 108 ft. long by 22 ft. high measured at its deepest point, and is composed of split granite laid up dry in a gorge having ledge sides and bottom. The dam is approximately 22 ft. thick at the base and 5 ft. at the crest. There is an aperture 4 ft. wide by 2 1/2 ft. deep located about 10 ft. up from the bottom for a discharge opening.

The accompanying blue print ^{"A"} shows the dam in plan, down stream elevation and in section. Blue print "B" shows the gate frame, gate and water rack which I have designed for the repair work to the dam. The face of the dam was originally pointed with cement, but after many years existence a large portion of the pointing has worked out, and I have recommended and it is the Company's purpose, to clear the entire face of the dam from top to bottom removing all loose cement and vegetable growth, and to again point all of the crevices with cement mortar.

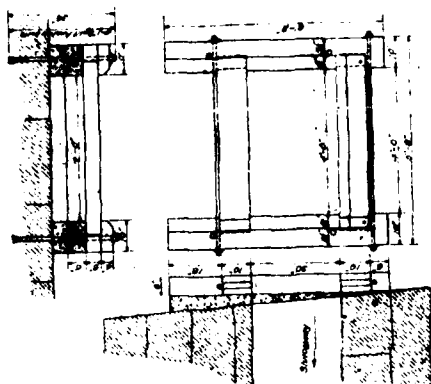
Sept. 21, 1923.

About 200 ft. to the right of the dam, looking up stream, there is a stone spillway founded on solid ledge having a length about 26 ft., the crest of which is approximately 4 ft. below the level of the storage dam. As there is but about 2 1/2 square miles of drainage area tributary to the pond above this dam, in my opinion, the spillway is ample to take care of any run-off that may occur. Besides as the dam is built entirely of stone founded on solid ledge no harm can result, even if it was over-topped by the water in extreme cases. I, therefore, consider the dam perfectly safe and practicable for the storage of water when the above mentioned repairs are completed.

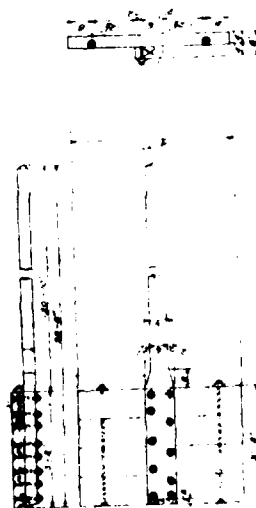
Very truly yours,



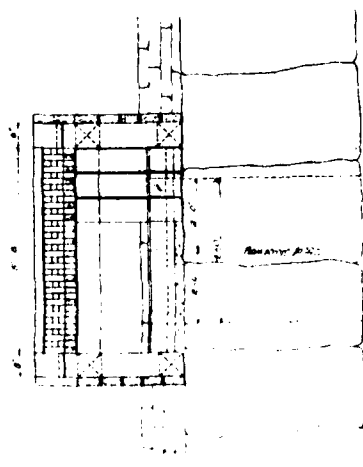
Copies:
Office
New England Box Co.



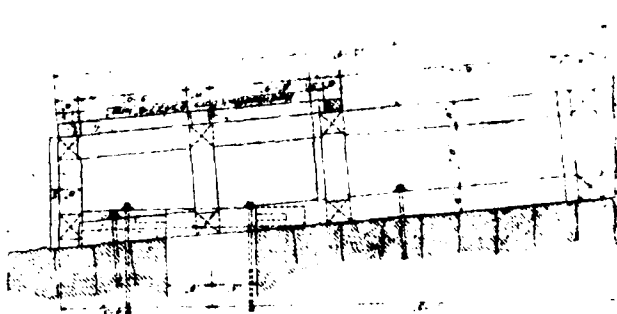
Box of Canteen Apr 2-11
Box 1-11-11



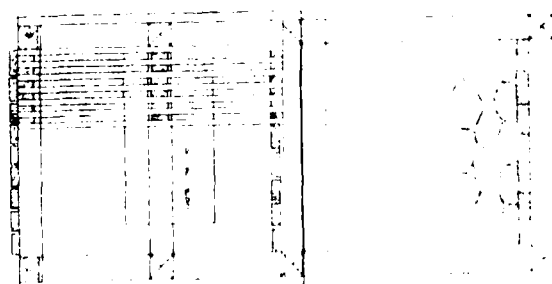
DETAILS OF CASE NO 5-B



TOP VIEW GATE AND RACK N91-B
30-1-10-0



Side View of Cattle and Rack M4-B



FRONT VIEW OF GATE AND RACK NO 3-B

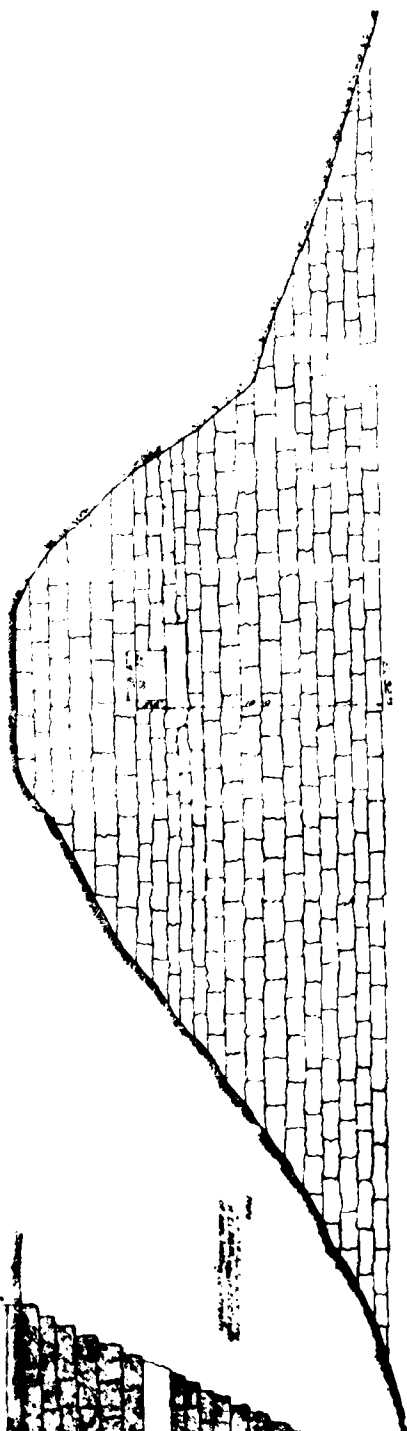
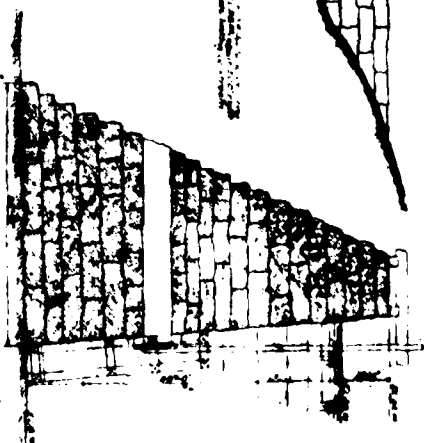
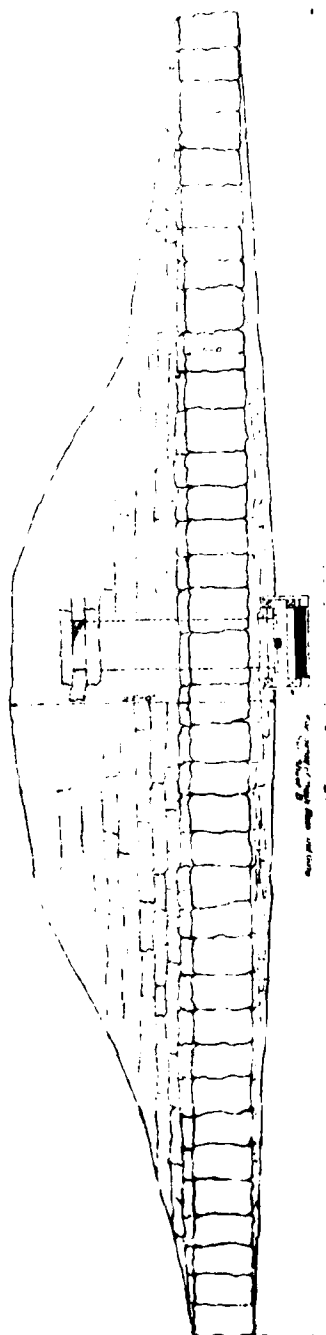
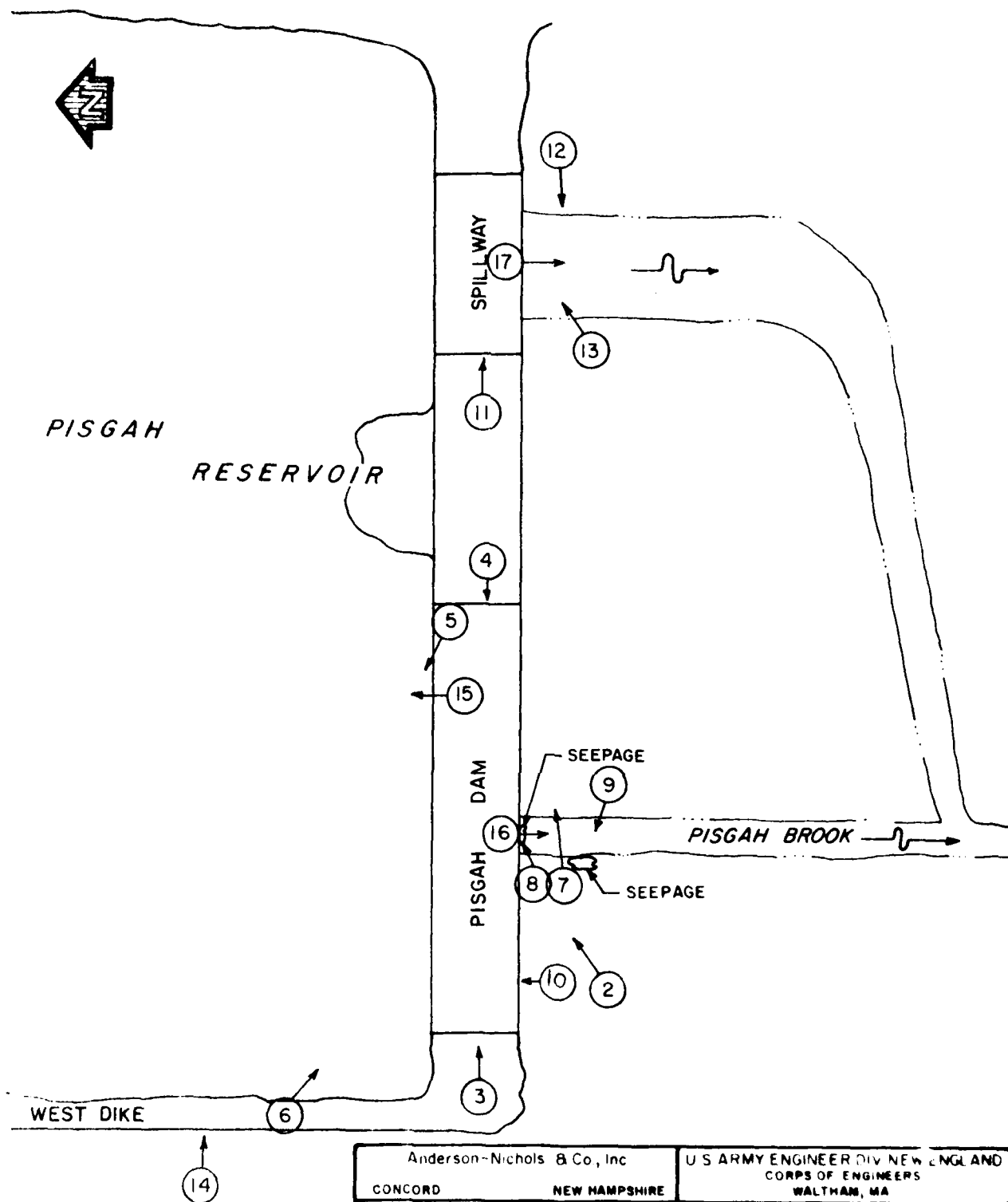


Photo:
Dr. Wang and others this year



APPENDIX C
PHOTOGRAPHS



| | | | |
|--|--|-----------------------------------|--|
| Anderson-Nichols & Co., Inc. | | U S ARMY ENGINEER DIV NEW ENGLAND | |
| CONCORD | | CORPS OF ENGINEERS | |
| NEW HAMPSHIRE | | WALTHAM, MA | |
| NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS | | | |
| PISGAH RESERVOIR DAM | | | |
| PHOTO INDEX | | | |
| PISGAH BROOK | | NEW HAMPSHIRE | |
| | | SCALE NOT TO SCALE | |
| | | DATE JULY 1979 | |



May 2, 1979

Figure 2 - View of bulging rock on downstream face of dam.



May 2, 1979

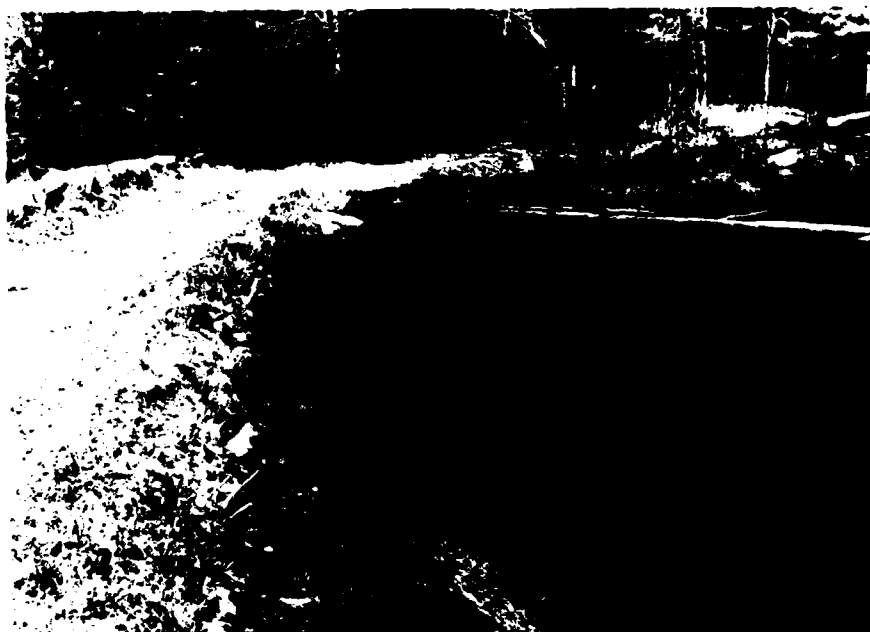
Figure 3 - View looking east across crest of dam.

C-2



May 2, 1979

Figure 4 - View looking west across crest of dam.



May 2, 1979

Figure 5 - Close-up view of upstream face of dam.



May 2, 1979

Figure 6 - View looking at upstream face of dam.



May 2, 1979

Figure 7 - View of contact between downstream face of dam and abutment showing large trees lying against the face.



May 2, 1979

Figure 8 - View of seepage discharging at downstream toe.



May 2, 1979

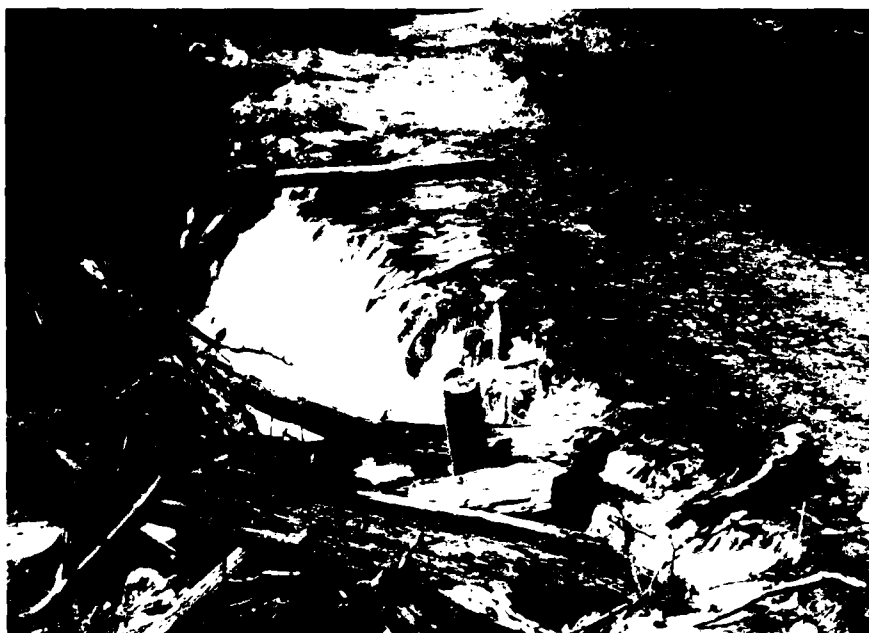
Figure 9 - View of seepage along west bank of downstream channel about 15 feet downstream of toe of dam.



Figure 10 - View of mid-level outlet. May 2, 1979



Figure 11 - View looking east across spillway. May 2, 1979



May 2, 1979

Figure 12 - View looking at debris on downstream face of spillway.



May 2, 1979

Figure 13 - View looking upstream at downstream face of spillway.



May 2, 1979

Figure 14 - Close-up view of west masonry dike.



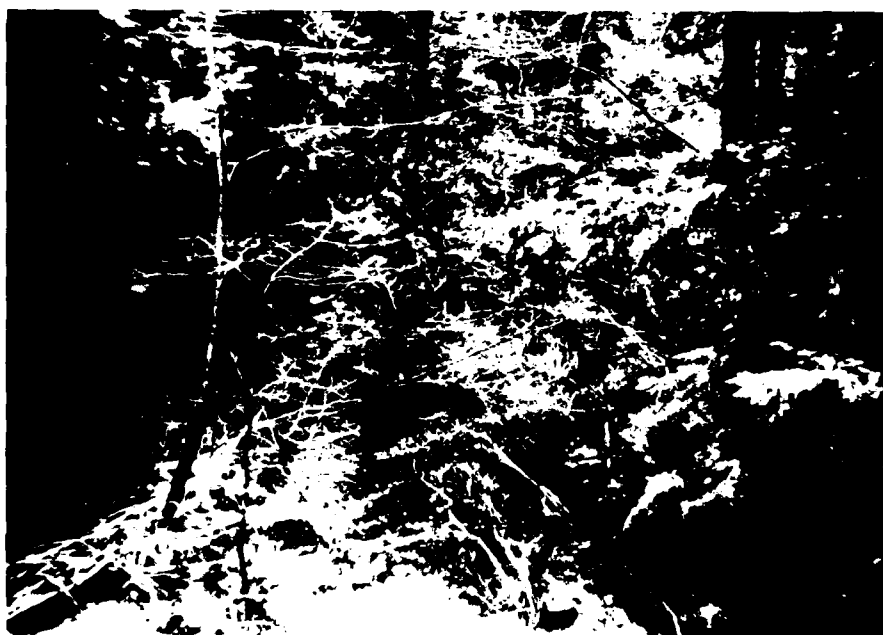
May 2, 1979

Figure 15 - View looking upstream into reservoir from dam crest.



May 2, 1979

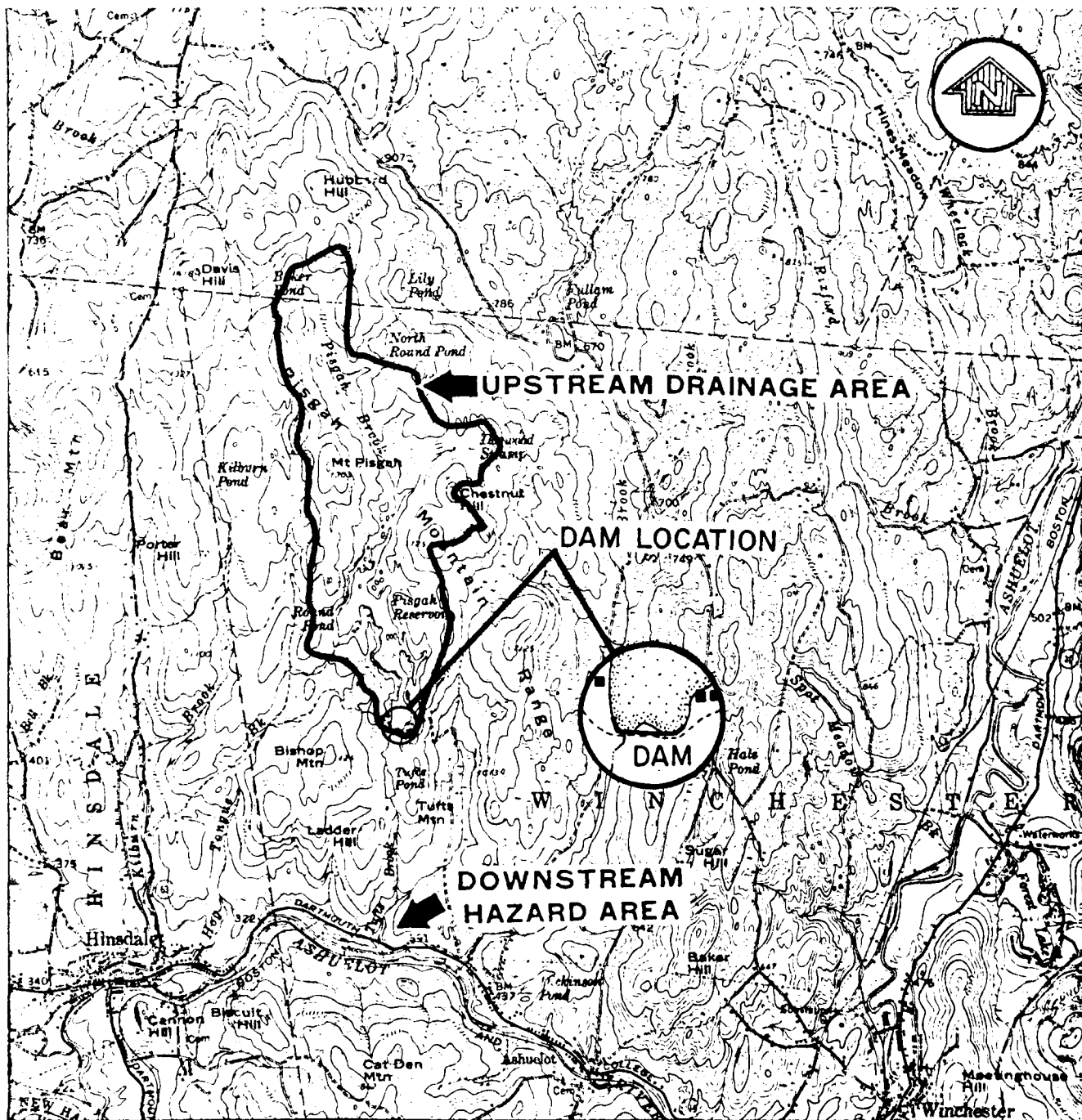
Figure 16 - View looking at channel downstream of dam.



May 2, 1979

Figure 17 - View of spillway discharge channel.

APPENDIX D
HYDROLOGIC AND HYDRAULIC COMPUTATIONS



**NATIONAL PROGRAM OF INSPECTION OF
NON-FED DAMS**

**PISGAH RESERVOIR DAM
WINCHESTER, NEW HAMPSHIRE**

REGIONAL VICINITY MAP

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

ANDERSON-NICHOLS & CO., INC.

CONCORD, NH

SCALE IN MILES



MAP BASED ON U.S.G.S. 15 MINUTE QUADRANGLE
SHEET. KEENE, N.H.-VT. 1958.

JOB NO. 3220-15

Pisgah Reservoir

HYDROLOGY/HYDRAULICS

$$D.A. = 2.37 \text{ mi}^2 = 2.4 \text{ mi}^2$$

Size Classification = Small

HAZARD Classification = SIGNIFICANT

TEST Flood = $\frac{1}{2}$ PMF

Calculate PMF using "Preliminary Guidance
 for Estimating Maximum Probable Discharges
 in Phase E Dam Safety Investigation,
 March, 1978"

Slope of watershed = 201'/mi so
 the mountainous curve was used.

$$\text{@ } 2.4 \text{ mi}^2, \text{ PMF in CFS/mi}^2 = 2510 = 2510$$

$$(2.4)(2510) = 6024 \text{ CFS}$$

$$\frac{1}{2} \text{ PMF} = 3012 \text{ CFS} = \text{Peak inflow to Pisgah Reservoir} = 3010 \text{ CFS}$$

Route inflow to Pisgah Reservoir to obtain
 outflow for test flood.

Develop rating curve for Pisgah Reservoir Dam
 flow is uncontrolled.

Outflow elevation = 818' MSL

JOB NO. 3220-15

Pisgah Reservoir

Date 5/23/79

Computed KAS

Checked R

AREAS 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

N SCALE

Rating Curve at Dam

TRIAL #1 ELEVATION 878' SPILLWAY

WEIR EQN =

$$Q = CLH^{3/2}$$

$$Q = C(L \times H)^{3/2}$$

$$Q = 0$$

TRIAL #2 ELEV 879'

$$Q = (2.7)(40)(.5)^{3/2} + 2.5(25)(.5)^{3/2}$$

$$38 + 22 = 60 \text{ CFS}$$

TRIAL #3 ELEV 880'

$$Q = 2.7(70)(1)^{3/2} + 2.5(27)(1)^{3/2} + 2.5(25)(.5)^{3/2}$$

$$= 139 + 67.5 + 22.1 = 229 \text{ CFS}$$

$$Q = 279 \text{ CFS}$$

TRIAL #4 ELEV 881'

$$Q = 2.7(60)(1.5)^{3/2} + 2.7(60)(.75)^{3/2} + 2.5(20)(.75)^{3/2} + 2.5(25)(.5)^{3/2} + 2.5(25)(2)^{3/2} + 2.5(15)(.5)^{3/2} + 2.5(15)(.25)^{3/2} + 2.5(25)(.25)^{3/2} =$$

$$Q = 248 + 105 + 32 + 22 + 177 + 13 + 3 + 8 = 658 \text{ CFS}$$

TRIAL #5 ELEV 880.5' TO DAM

$$Q = 2.7(60)(0.75)^{3/2} + 2.7(60)(1)^{3/2} + 2.7(12)(0.5)^{3/2} + 2.5(25)(.5)^{3/2} + 2.5(30)(1.5)^{3/2} =$$

$$Q = 105 + 162 + 11 + 22 + 138 = 438 \text{ CFS}$$

JOB NO. 3220-15

Pisgah Reservoir

 Date _____
 Computed _____
 Checked _____

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

TRIAL # 6 ELEV 882'

$$Q = 2.7(60)(.75)^{3/2} + 2.7(60)(2.5)^{3/2} + 2.5(33)(1.75)^{3/2} +$$

$$2.5(25)(.5)^{3/2} + 2.5(25)(.5)^{3/2} + 2.5(70)(1.5)^{3/2} +$$

$$2.5(15)(.5)^{3/2} + 2.5(30)(.75)^{3/2} + 2.5(50)(.3)^{3/2} + 2.5(40)(.25)^{3/2} +$$

$$2.5(25)(.25)^{3/2} + 2.5(45)(.5)^{3/2} + 2.5(20)(.5)^{3/2} + 2.5(25)(1)^{3/2} =$$

$$Q = 105 + 640 + 115 + 22 + 325 + 92 + 13 + 49 + 20 + 19 +$$

$$8 + 57 + 25 + 62 = 1553 \text{ CFS}$$

TRIAL # 7 ELEV 883'

$$Q = 2.7(60)(.5)^{3/2} + 2.5(45)(.5)^{3/2} + 2.7(60)(.75)^{3/2} +$$

$$2.5(25)(.5)^{3/2} + 2.5(25)(.4)^{3/2} + 2.5(25)(.6)^{3/2} +$$

$$2.5(10)(.1)^{3/2} + 2.5(10)(.2)^{3/2} + 2.5(10)(.4)^{3/2} +$$

$$2.5(30)(.3)^{3/2} + 2.5(30)(.6)^{3/2} + 2.5(50)(.3)^{3/2} +$$

$$2.5(50)(1)^{3/2} + 2.5(20)(.5)^{3/2} + 2.5(20)(.25)^{3/2} +$$

$$2.5(25)(.25)^{3/2} + 2.5(45)(1.5)^{3/2} + 2.5(20)(.75)^{3/2} +$$

$$2.5(60)(.25)^{3/2} + 2.5(30)(.5)^{3/2} + 2.5(30)(.5)^{3/2} +$$

$$2.5(30)(.5)^{3/2} =$$

$$Q = 1061 + 737 + 105 + 22 + 500 + 177 + 25 + 33 + 6 + 11 +$$

$$35 + 20 + 125 + 18 + 6 + 8 + 436 + 32 + 9 +$$

$$+ 27 + 27 + 27 = 3557 \text{ CFS}$$

TRIAL # 8 ELEV 884'

$$Q = 2.7(60)(.75)^{3/2} + 2.7(60)(4.5)^{3/2} + 2.5(55)(2.25)^{3/2} +$$

$$2.5(25)(.5)^{3/2} + 2.5(25)(.5)^{3/2} + 2.5(30)(.25)^{3/2} +$$

$$2.7(90)(1)^{3/2} + 2.7(10)(2.25)^{3/2} + 2.5(10)(.4)^{3/2} +$$

$$2.5(13)(1.5)^{3/2} + 2.5(30)(1.5)^{3/2} + 2.5(30)(2)^{3/2} +$$

$$2.5(50)(.3)^{3/2} + 2.5(50)(2)^{3/2} + 2.5(20)(.25)^{3/2} +$$

$$2.5(30)(.5)^{3/2} + 2.5(25)(1.5)^{3/2} + 2.5(15)(.75)^{3/2} +$$

$$2.5(20)(.75)^{3/2} + 2.5(45)(1)^{3/2} + 2.5(60)(.25)^{3/2} +$$

$$2.5(25)(.25)^{3/2} + 2.5(10)(.25)^{3/2} + 2.5(25)(.5)^{3/2} =$$

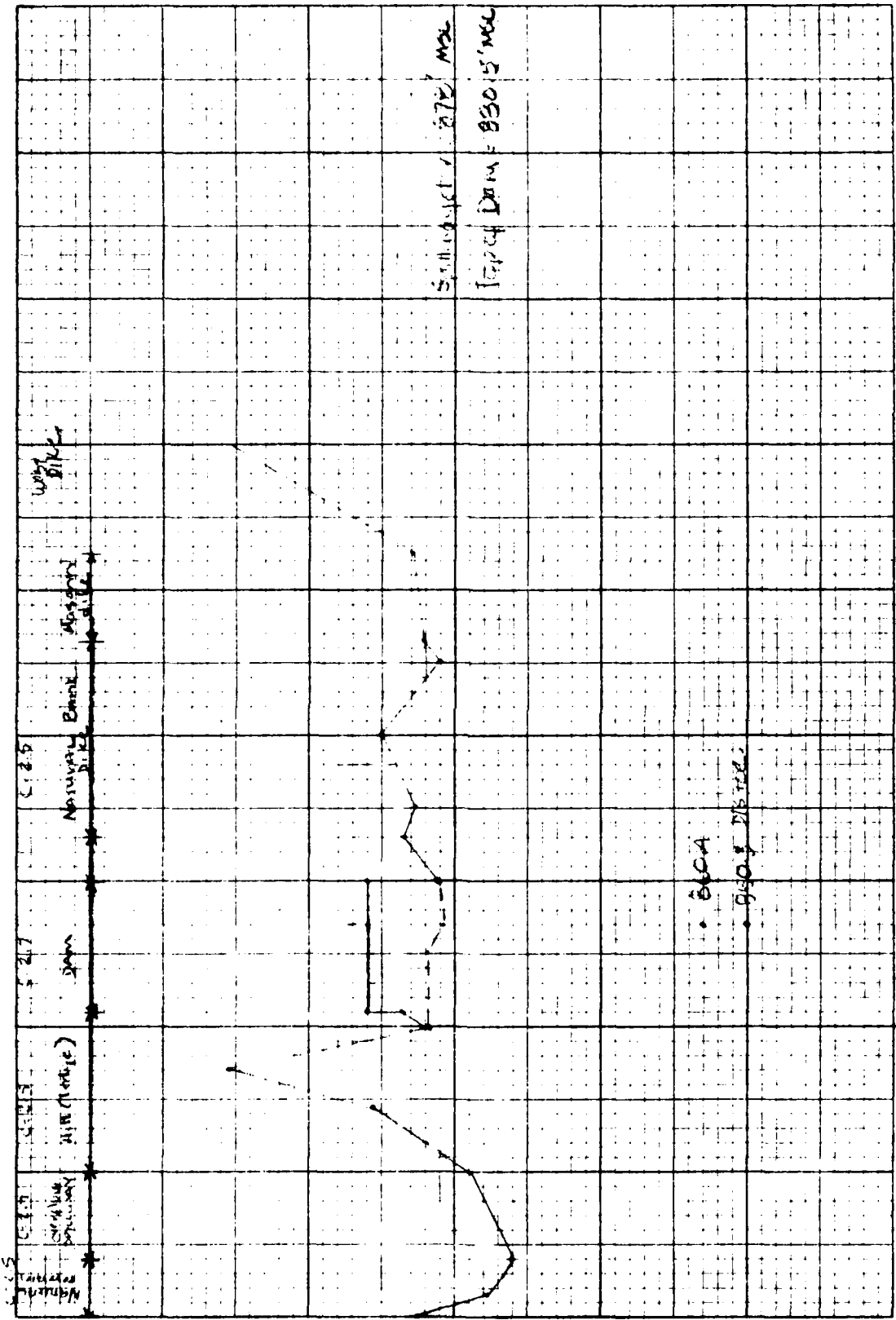
$$Q = 105 + 1546 + 464 + 22 + 699 + 296 + 243 + 9 +$$

$$6 + 60 + 138 + 212 + 21 + 354 + 6 + 27 + 758 +$$

$$24 + 32 + 238 + 19 + 8 + 3 + 22 = 5394 \text{ CFS}$$

4118

1. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840. 841. 842. 843. 844. 845. 846. 847. 848. 849. 850. 851. 852. 853. 854. 855. 856. 857. 858. 859. 860. 861. 862. 863. 864. 865. 866. 867. 868. 869. 870. 871. 872. 873. 874. 875. 876. 877. 878. 879. 880. 881. 882. 883. 884. 885. 886. 887. 888. 889. 890. 891. 892. 893. 894. 895. 896. 897. 898. 899. 900. 901. 902. 903. 904. 905. 906. 907. 908. 909. 910. 911. 912. 913. 914. 915. 916. 917. 918. 919. 920. 921. 922. 923. 924. 925. 926. 927. 928. 929. 930. 931. 932. 933. 934. 935. 936. 937. 938. 939. 940. 941. 942. 943. 944. 945. 946. 947. 948. 949. 950. 951. 952. 953. 954. 955. 956. 957. 958. 959. 960. 961. 962. 963. 964. 965. 966. 967. 968. 969. 970. 971. 972. 973. 974. 975. 976. 977. 978. 979. 980. 981. 982. 983. 984. 985. 986. 987. 988. 989. 990. 991. 992. 993. 994. 995. 996. 997. 998. 999. 1000.



830.5

872

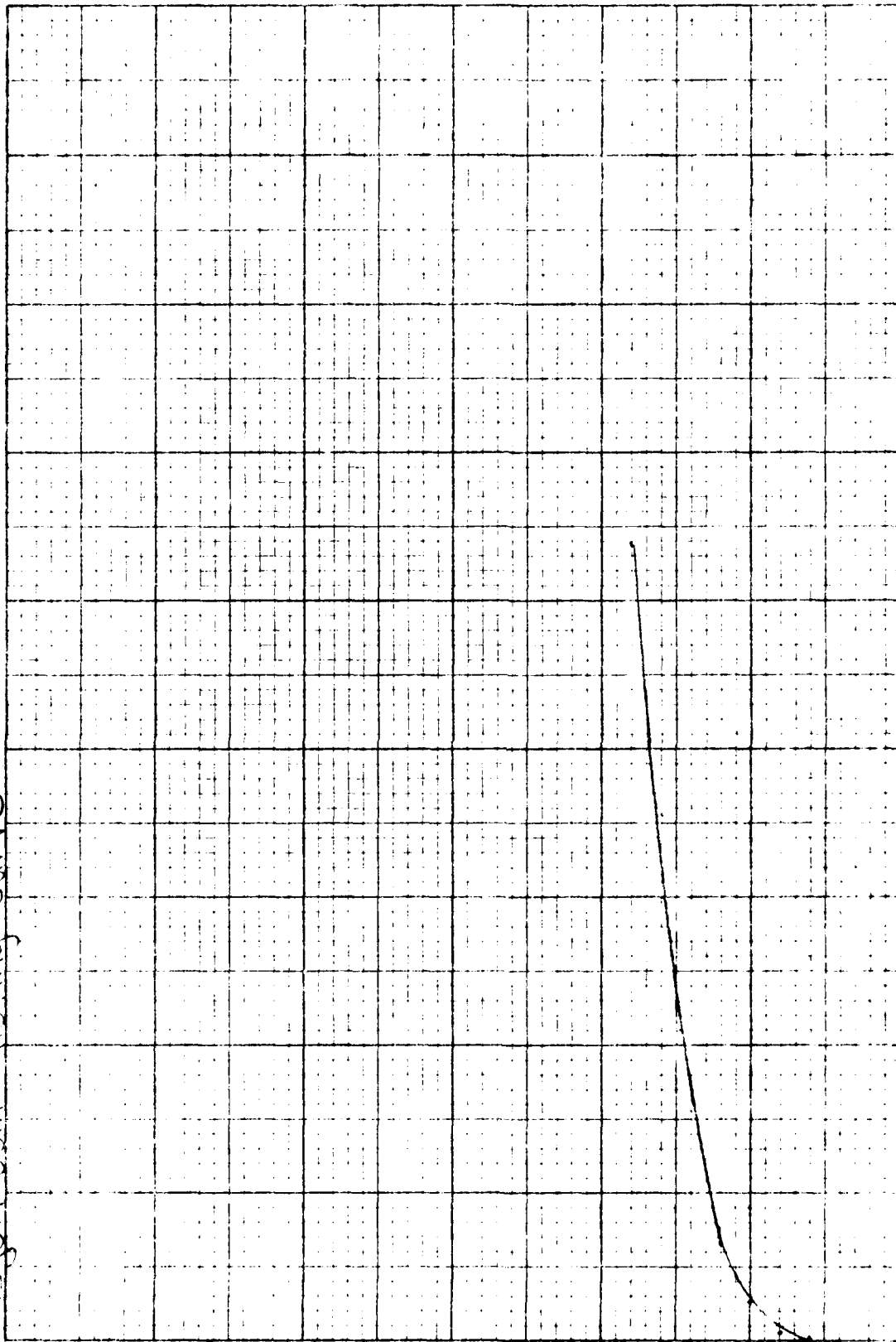
830.5

D-5

872

830.5

Dragage, Dredge - Rating Curve



207

25



4

3

2007-10-14

JOB NO. 3220-15

Project _____

A S 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
N SCALE

Determine Volume of Surcharge and increase of Runoff:

Assume Normal Storage at elevation 878' to be
666" from Inflow/Sheet

Surface Area = 108.8 acres

"Frustum of 1 part" "

for storage-elevation curve

$$V = \frac{1}{3}h (b_1 + \sqrt{b_1 b_2} + b_2)$$

h = elevation normal pool
 b_1 = normal pool S.A. (acres)
 b_2 = enlarged S.A. (acres)

a) 880 S.A. = 112 acres

$$V = \frac{1}{3} (2) (108.8 + 112 + \sqrt{108.8(112)})$$

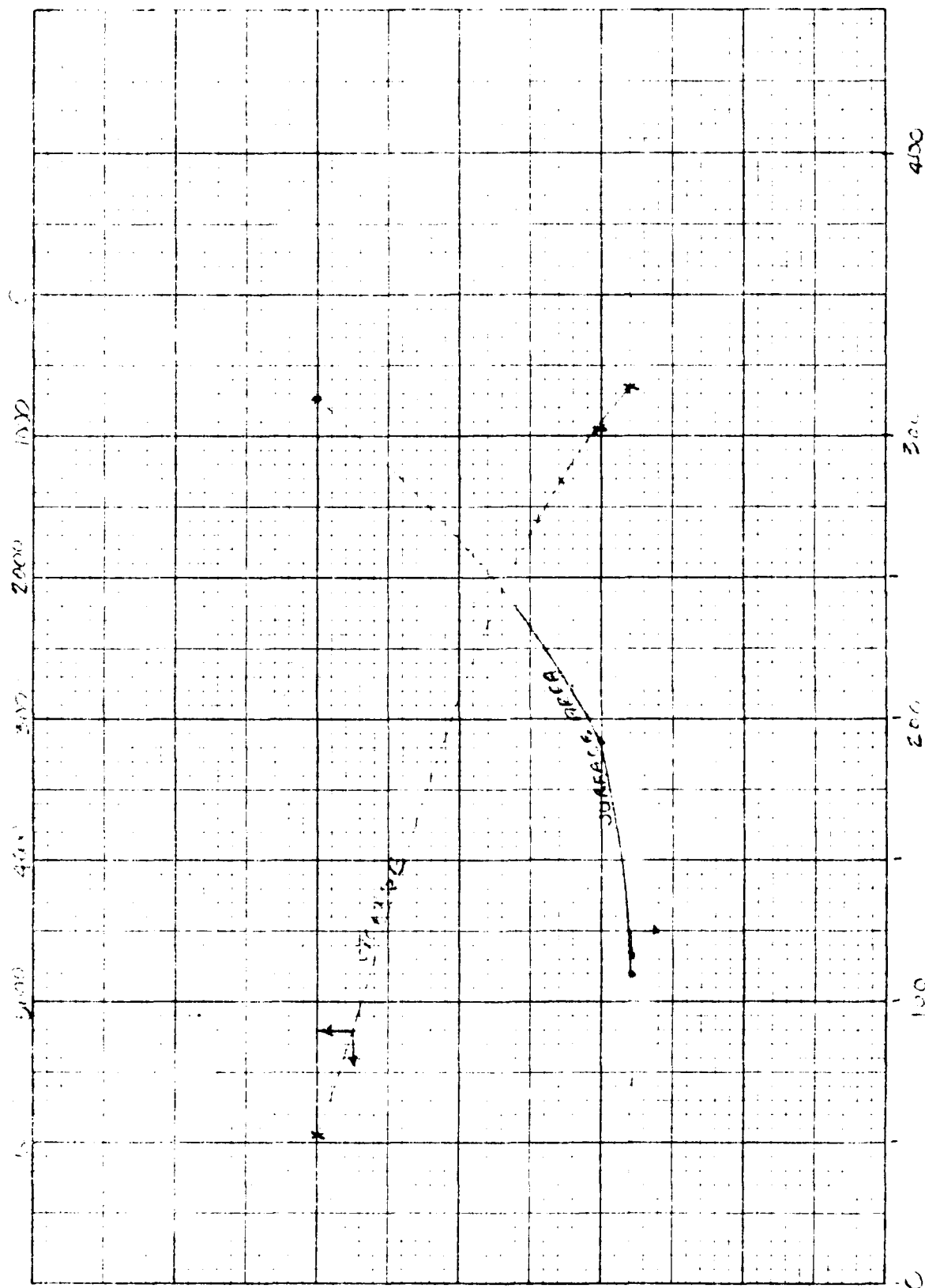
$$V = 296 \text{ ac-ft} + 660 \text{ ac-ft} = 956 \text{ ac-ft}$$

b) 900 S.A. = 116 acres

$$V = \frac{1}{3} (20) (112 + 116 + \sqrt{112(116)})$$

$$V = 5006 \text{ ac-ft} + 156 \text{ ac-ft} = 5962 \text{ ac-ft}$$

X. C. J. J. J.



• (634.61-928) 200ms

JOB NO. 5027-15

Payson Reservoir

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

For 1/2 inch rainfall at Payson Reservoir, an elevation of 882.9 is read from the rating curve.

A storage of 15.1 million ft³ is read from the storage-elevation curve.

TO CONVERT INCHES OF RUNOFF:

$$\begin{array}{r} 1320 \text{ AF} \\ - 660 \text{ AF} \\ \hline 660 \text{ AF} \end{array}$$

$$660 \text{ AF} \times \frac{1}{2.4 \text{ mi}^2} \times \frac{1 \text{ mi}^2}{640 \text{ ac}} = 0.43 \text{ ft}$$

$$.43' \times 12''/\text{ft} = 5.2'' = \text{STOR 1}$$

$$Q_{P2} = Q_{P1} \times \left(1 - \frac{\text{STOR 1}}{19.2}\right)$$

$$Q_{P2} = 3010 \times \left(1 - \frac{5.2}{19.2}\right) = 1362 \text{ CFS} = Q_{P2}$$

Determine surcharge height to pass Q_{P2} from rating curve = 881.6' MSL

Determine storage at 881.6' from storage-elevation curve = 1100 AF

$$\begin{array}{r} 1100 \text{ AF} \\ - 660 \\ \hline 440 \text{ AF} \end{array}$$

TO CONVERT TO INCHES OF RUNOFF:

$$440 \text{ AF} \times \frac{1}{2.4 \text{ mi}^2} \times \frac{1 \text{ mi}^2}{640 \text{ ac}} = 0.29' = 3.5'' = \text{STOR 2}$$

$$\text{STOR 1} = 5.2''$$

$$\text{STOR 2} = 3.5''$$

$$\text{AVC} = 2 \sqrt{8.7''} = 4.4'' = 0.37'$$

$$(0.37')(2.4 \text{ mi}^2) \left(\frac{640 \text{ ac}}{\text{mi}^2}\right) = 568 \text{ AF}$$

$$\begin{array}{r} 1060 \\ + 568 \\ \hline 1628 \text{ AF} \end{array}$$

$$Q_{1228 \text{ AF}}$$

From storage-elevation curve: elev. = 882.3' MSL

From rating curve: Outflow $Q = 2100 \text{ CFS}$

$$2100 \text{ CFS} = 882.3' \text{ MSL}$$

JOB NO. 3220-15

Pisgah Reservoir

 ES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29
 SCALE

BREACH ANALYSIS

Storage at maximum pool: 750 ac-ft

Storage at normal pool: 660 ac-ft

D.A. = 2.4 mi²

$$Q_p = 8/27 W_b \sqrt{g} y_o^{3/2}$$

$$Q_p = 8/27 (36) \sqrt{32.2} (22.4)^{3/2}$$

$$Q_p = 6405 \text{ max pool}$$

Q over spillway not breached.

$$Q = 2.7 C H^{3/2} \approx 880.5$$

$$Q = 2.7(40)(1)^{3/2} + 2.7(15)(5)^{3/2} + 2.7(40)(5)^{3/2} + 2.7(15)(1)^{3/2}$$

$$106 + 114 + 38 + 41 = 201$$

TOTAL BREACH (Q at max pool =

$$6405 + 201 = 6606, \text{ say } 6605 \text{ cfs}$$

6605 cfs on rating curve = 15.9 stage (Pg. D-16)

438 cfs (average discharge) on rating curve = 5.7

Therefore, increase in stage would be

$$15.9 - 5.7 = 10.2 \text{ feet}$$

D-11

Wb = Breach width

$$g = 32.2 \text{ ft/sec}^2$$

y_o = pool elev -
w/s river bed

Dam length = 90'

+ 10% = 36'

$$380.1 - 22 = 358.1$$

= 4/5 RIVER BED

880.5 MAX POOL

$$\frac{880.1}{22.4'}$$

100-1000

High to low

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29

SCALE

BRFACH BULLY (CONT)

The resulting overtopping of Route 19 would be
should be about 10 feet high. This would result in severe damage to
the roadway and the bridge. The
land adjacent to the house on the
bank of this Brook. This would also result in
the 18.2 foot increase in stage. downstream
would cause serious damage to the bridge
as well as threaten the lives of the
inhabitants.

JOB NO. 3220-15

Pisgah Reservoir

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

TYPICAL X-SECTION DIS

USE TYPICAL CROSS-SECTION ALONG DIS REACH FROM THE DAM TO MOUTH AND ESTABLISH A DISCHARGE RATING CURVE USING MANNING'S EQUATION:

$$Q = \frac{1.49}{n} \cdot A \cdot R^{2/3} \cdot S^{1/2}$$

n = composite 'n' value

A = area of section (ft²)

R = A/WP (wetted perimeter)

S = slope of reach

Length of reach: 4435'

ELEV @ DIS TOE: 871.7

ELEV @ END REACH: 600'

SLOPE = 0.06

Composite 'n' = 0.07

THE TRIALS BELOW REFER TO THE DIS HAZARD CROSS-SECTION ON PAGE 14.

TRIAL #1 ASSUME STAGE = 2'

AREA = 15

WP = 19

$R = A/WP = 15/19 = 0.79$

$Q = 65$ CFS

$$Q = \frac{1.49}{0.07} (15) (.79)^{2/3} (.06)^{1/2} = 65$$

TRIAL #2 ASSUME STAGE = 4'

AREA = 25

WP = 29

$R = A/WP = 25/29 = 0.86$

$Q = 116 + 65 = 181$

$$Q = \frac{1.49}{0.07} (25) (.86)^{2/3} (.06)^{1/2} = 116$$

TRIAL #3 ASSUME STAGE = 6'

AREA = 60

WP = 38

$R = A/WP = 60/38 = 1.58$

$Q = 417 + 65 = 482$

$$Q = \frac{1.49}{0.07} (60) (1.58)^{2/3} (.06)^{1/2} = 417$$

JOB NO. 3270-15

Ingenieur

D. 1000 (1000 ft)

TRIAL #4 ASSUMING SINGLE 8'

AREA = 106

WP = 49

 $R = A/WP = 106/49 = 2.2$ $Q = 921 + 65 = 986$

$$Q = \frac{1.49}{.07} (106)^{2/3} (.06)^{1/2}$$

$$= 921$$

TRIAL #5 ASSUMING SINGLE 10'

AREA = 162

WP = 59

 $R = A/WP = 162/59 = 2.74$ $Q = 1656 + 65 = 1721$

$$Q = \frac{1.49}{.07} (162)^{2/3} (.06)^{1/2}$$

$$= 1656$$

TRIAL #6 ASSUMING SINGLE 12'

AREA = 231

WP = 68

 $R = A/WP = 231/68 = 3.44$ $Q = 2739 + 65 = 2804$

$$Q = \frac{1.49}{.07} (231)^{2/3} (.06)^{1/2}$$

$$= 2739$$

TRIAL #7 ASSUMING SINGLE 14'

AREA = 329

WP = 76

 $R = A/WP = 329/76 = 4.33$ $Q = 4470$

$$Q = \frac{1.49}{.07} (329)^{2/3} (.06)^{1/2}$$

$$= 4470$$

TRIAL #8 ASSUMING SINGLE 16'

AREA = 440

WP = 87

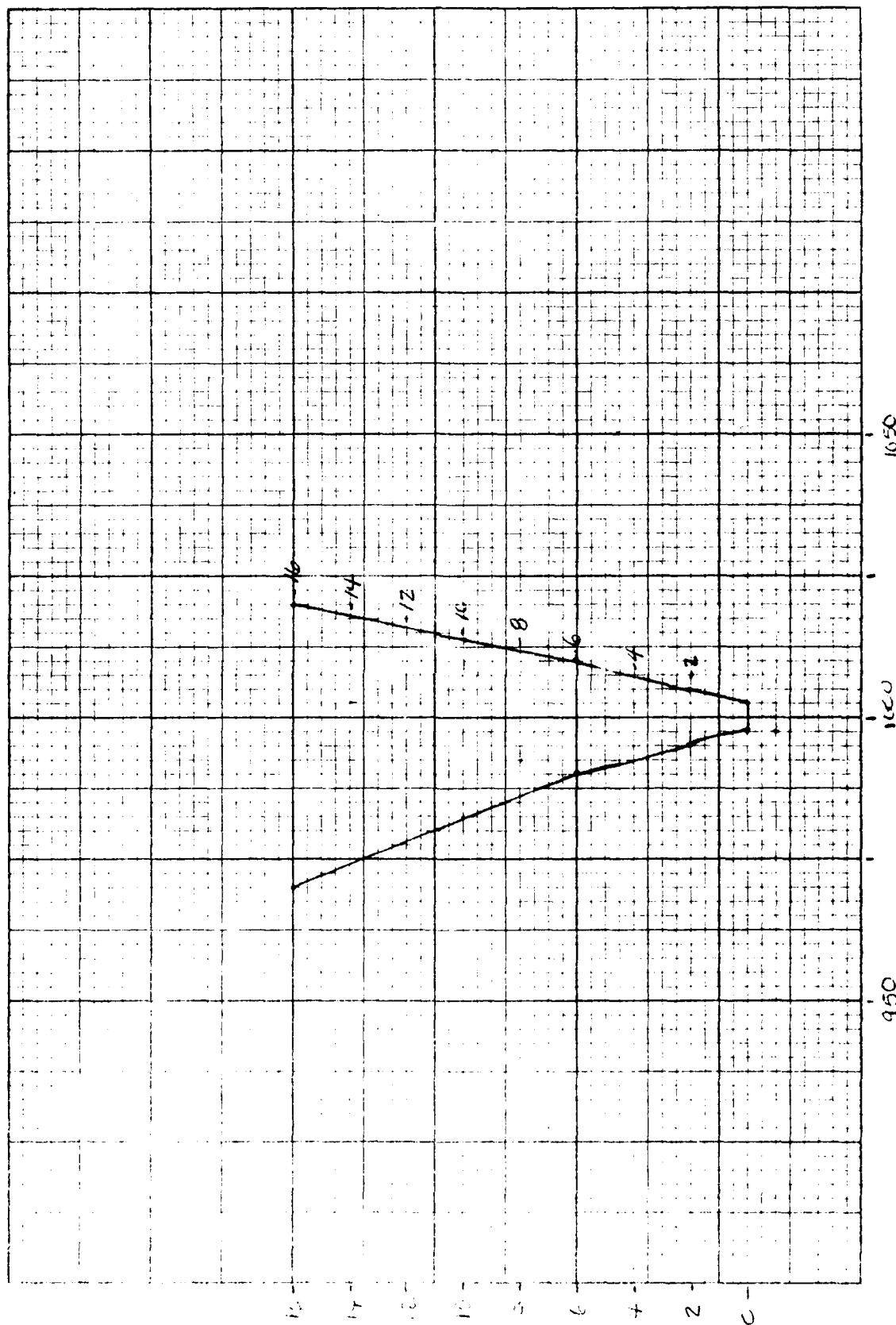
 $R = A/WP = 440/87 = 5.06$ $Q = 6665$

$$Q = \frac{1.49}{.07} (440)^{2/3} (.06)^{1/2}$$

$$= 6665$$

Flagan, K. K. 1511
5/16/79
KBS

D/S CROSS-SECTION



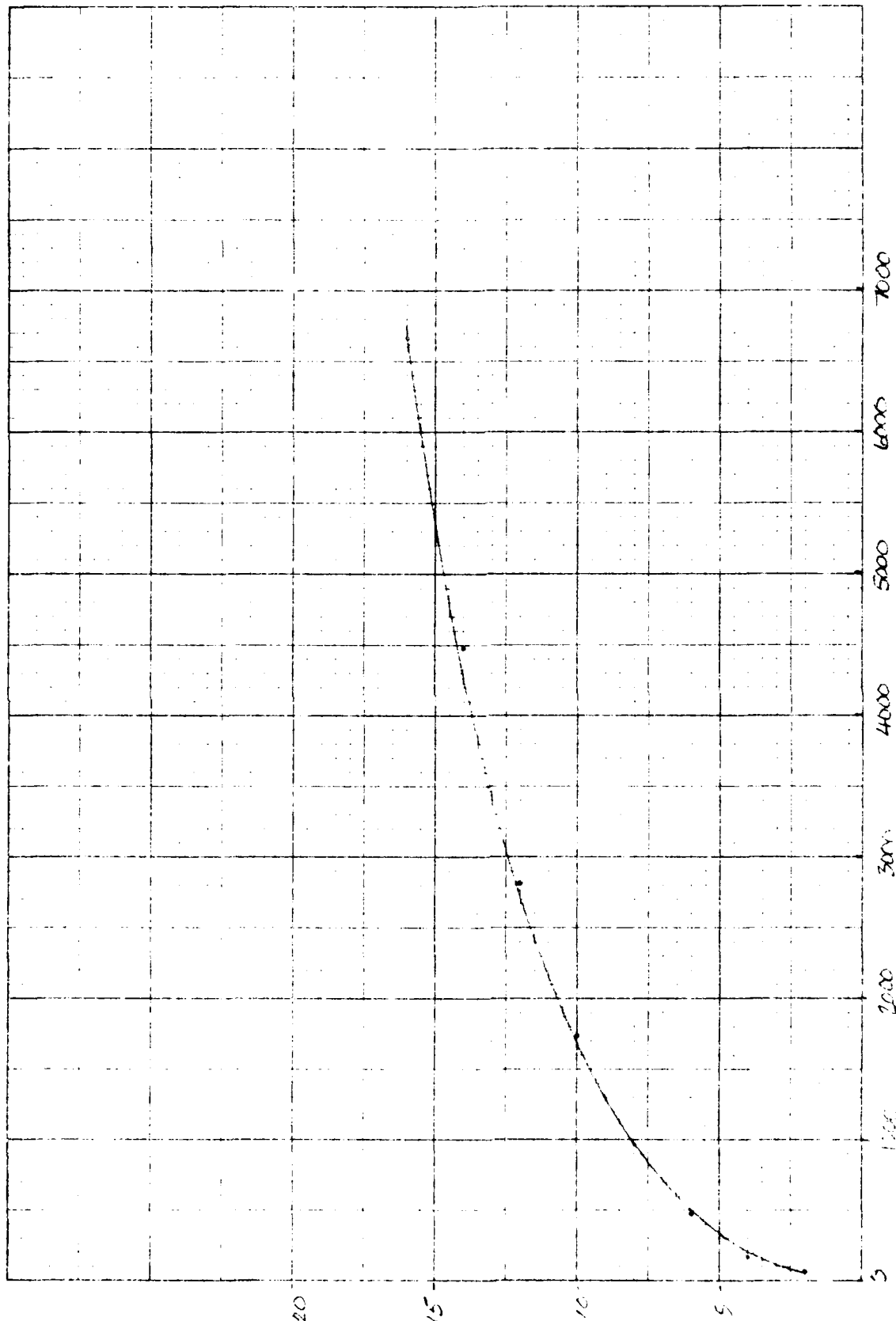
D-15

CROSS-SECTION

HAZARD RESERVOIR
6-29-79
KBS

D-16 HAZARD RATING CURVE

15 (19)



DISCHARGE (CFS)

D-16

(1979-1980)

JOB NO. 3220-15

Pisgah Reservoir

SQUARES 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
4 IN. SCALEWEIR SECTION @ RTE 119
DOWNSTREAM HAZARD ANALYSIS

TRIAL #1 STAGE = 2'

$$Q = (2.6 \times 90 \times 2)^{3/2} = 6602 \text{ CFS}$$

$$\text{WEIR EQN} = CLH^{3/2}$$

TRIAL #2 STAGE = 4'

$$Q = (2.6)(135)(4)^{3/2} = 2808 \text{ CFS}$$

TRIAL #3 STAGE = 5'

$$Q = (2.6)(182)(5)^{3/2} = 5290 \text{ CFS}$$

CAPACITY OF ROADWAY CULVERT

$$Q = (4.5 \times 54) \sqrt{2(32.2)(2.57)}$$

$$Q = 1873 \text{ CFS}$$

ORIFICE EQN.

$$Q = CA \sqrt{2gh}$$

$$\text{BREACH } Q = 6605 \text{ CFS}$$

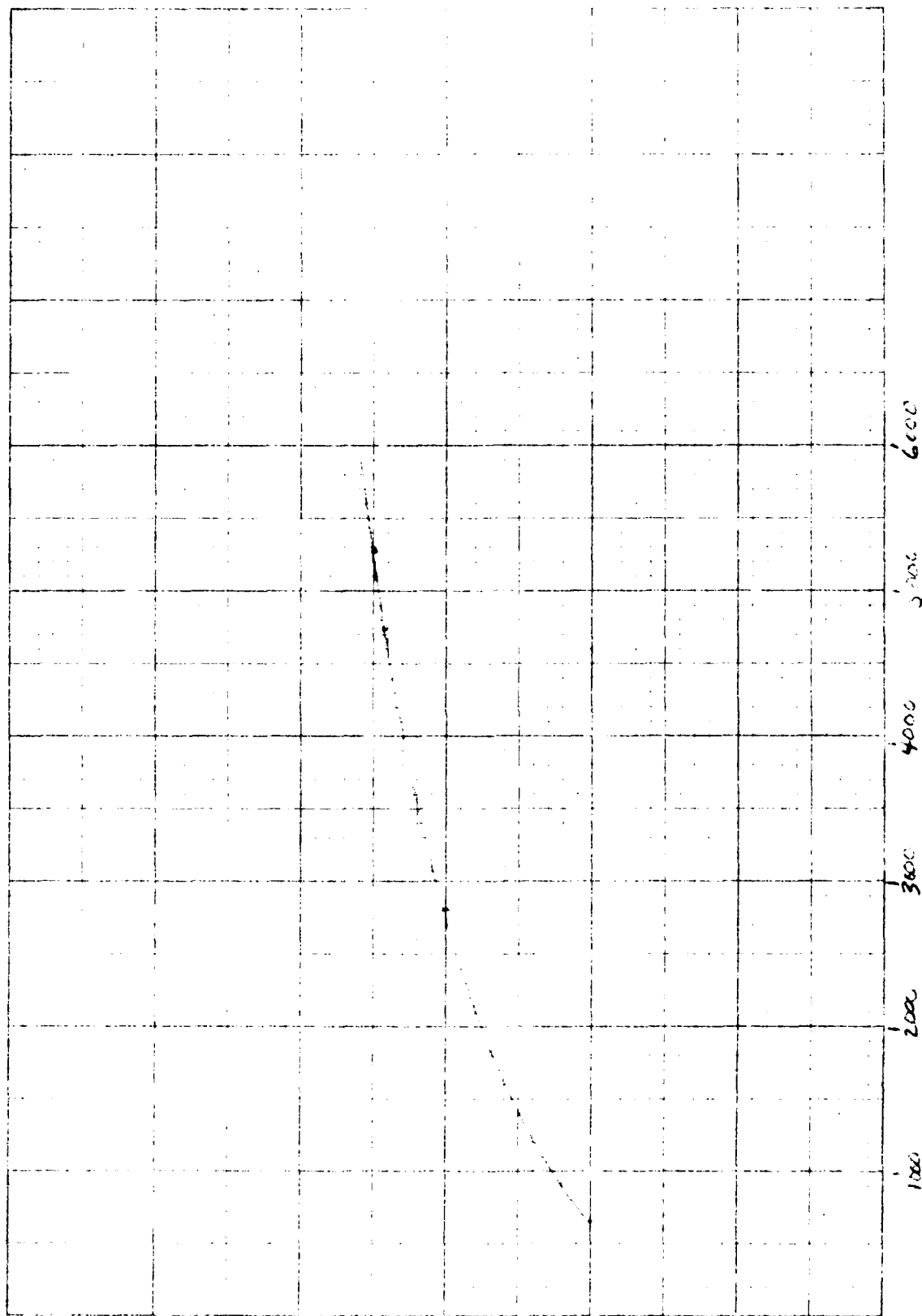
$$6605 - 1873 = 4732 \text{ CFS OVER ROAD}$$

$$4732 \text{ CFS ON RATING CURVE}_{(P.D.S)} = 4.8' \text{ OVER ROAD}$$

10-18-79
 6-24-79
 KES

170416

LOADING CURVE AT ROUTE 117



Q (CRS)

D-18

170416

JOB NO. 3220-15

Kisgan Reservoir

AREAS 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
IN, SCALE

GATE CAPACITIES

Determine approximate discharge capacities of gates
at 10' drain 885.0' msl

DRAIN GATE

$2'6" \text{ H} \times 4' \text{ W} = 10.4 \text{ ft}^2$

INVERT of GATE = 860.4

CENTERLINE OF GATE = 861.7

Capacity at 10' drain - 885.0' msl

$Q = CA \sqrt{2gh}$

$C = 0.7$

$q = 32.2$

A = area

h = head

$Q = .7 (10) \sqrt{2(32.2)24.15}$

$Q = 275 \text{ cfs}$

APPENDIX E

INFORMATION AS
CONTAINED IN THE NATIONAL
INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

| | | | | | | | | | | | | | | | | | |
|-----------------|-----|--------|-----|-------|----|--------|-----|-------|----|------|------------------------|------------------|--------|------------------|--------|---------------------------|---------|
| IDENTITY NUMBER | 301 | REGION | NED | STATE | NH | COUNTY | 005 | DIST. | 02 | NAME | PISCAGAM RESERVOIR DAM | LATITUDE (NORTH) | 4248.6 | LONGITUDE (WEST) | 7226.9 | REPORT DATE DAY MO YR | 05JUL79 |
|-----------------|-----|--------|-----|-------|----|--------|-----|-------|----|------|------------------------|------------------|--------|------------------|--------|---------------------------|---------|

| | | | |
|--------------|--------------|---------------------|--------------------|
| POPULAR NAME | PISCAGAM DAM | NAME OF IMPROVEMENT | PISCAGAM RESERVOIR |
|--------------|--------------|---------------------|--------------------|

| | | | | | | | | | |
|--------|-------|-----------------|----------------|--|---------|---------------------|---|------------|------|
| REGION | 01 08 | RIVER OR STREAM | PISCAGAM BROOK | NEAREST DOWNSTREAM CITY - TOWN - VILLAGE | WINDSLE | DIST FROM DAM (MI.) | 3 | POPULATION | 3270 |
|--------|-------|-----------------|----------------|--|---------|---------------------|---|------------|------|

| | | | | | | | | | | | | |
|-------------|------|----------------|------|----------|---|--------|----|--------------|----|----------------------------------|-----|-----|
| TYPE OF DAM | PGOT | YEAR COMPLETED | 1870 | PURPOSES | R | STATUS | 33 | HEIGHT (FT.) | 30 | INPOUNDING CAPACITIES (ACRE-FT.) | 950 | 660 |
|-------------|------|----------------|------|----------|---|--------|----|--------------|----|----------------------------------|-----|-----|

DIST OWN FED R PRV/FED SC8 A VER/DATE
NED N N N N 05JUL79

| | |
|---------|--|
| REMARKS | 21-01-STONE MASONRY 22-APPROXIMATE (REPAIRS IN 1923) |
|---------|--|

| | | | | | | | | | | | | | | | | | | | | |
|---------|---|----------|----|------|---|-------------|----|-------------------------|-----|--------------------|--|---------------------|--|---------------|--|-----|--------------|-------------|--------------|-------------|
| D/S HAS | 2 | SPILLWAY | 90 | TYPE | U | WIDTH (FT.) | 60 | MAXIMUM DISCHARGE (CFS) | 438 | VOLUME OF DAM (CY) | | POWER CAPACITY (MW) | | PROPOSED (MW) | | NO. | LENGTH (FT.) | WIDTH (FT.) | LENGTH (FT.) | WIDTH (FT.) |
|---------|---|----------|----|------|---|-------------|----|-------------------------|-----|--------------------|--|---------------------|--|---------------|--|-----|--------------|-------------|--------------|-------------|

| | | | | | |
|-------|----------------------|----------------|---------------------|-----------------|--|
| OWNER | NH DIVISION OF PARKS | ENGINEERING BY | I W JONES + COMPANY | CONSTRUCTION BY | |
|-------|----------------------|----------------|---------------------|-----------------|--|

| | | | | | | | |
|--------|--------------------|--------------|--------------------|-----------|--------------------|-------------|--------------------|
| DESIGN | NH WATER RES BOARD | CONSTRUCTION | NH WATER RES BOARD | OPERATION | NH WATER RES BOARD | MAINTENANCE | NH WATER RES BOARD |
|--------|--------------------|--------------|--------------------|-----------|--------------------|-------------|--------------------|

| | | | | | |
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| INSPECTION BY | ANDERSON-NICHOLS AND COMPANY INC | INSPECTION DATE DAY MO YR | 02MAY79 | AUTHORITY FOR INSPECTION | PUBLIC LAW 92-367 8AUG1972 |
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| REMARKS | 47 REPAIRS |
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END

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